PMM

Precision Metal Molding

NOVEMBER
1955

INCLUDING DIE CASTINGS MAGAZINE

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devoted exclusively to:

DIE CASTINGS

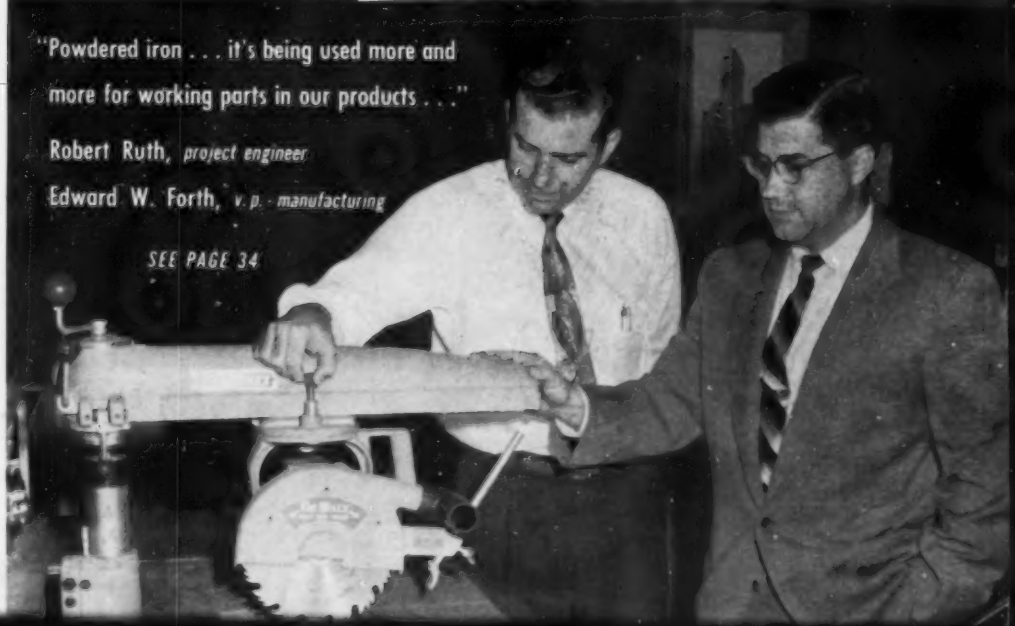
INVESTMENT CASTINGS

ERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS



"Powdered iron . . . it's being used more and more for working parts in our products . . ."

Robert Ruth, *project engineer*

Edward W. Forth, *v. p. - manufacturing*

SEE PAGE 34

UNIFORM QUALITY • PROMPT SERVICE • UNIFORM QUALITY • PROMPT SERVICE • UNIFORM QUALITY • PROMPT SERVICE •

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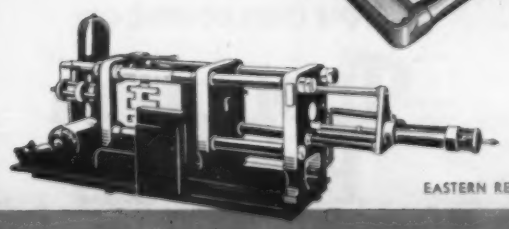
Built-in Rack and Pinion permits use of a ratchet wrench to quickly move the complete die-locking assembly in place to accommodate various sizes of dies.

Die-Lock Valve can be shut off and by-passed, with Inching Valve assuring added safety when setting up die. This permits instantaneous, micromatic control.



Faster set-up time is just one of the many "bonus" features which make Cast-Master today's outstanding choice in die-casting machines. To get the complete "bonus" story, send for the Cast-Master catalog, containing illustrations and specifications on eight new models.

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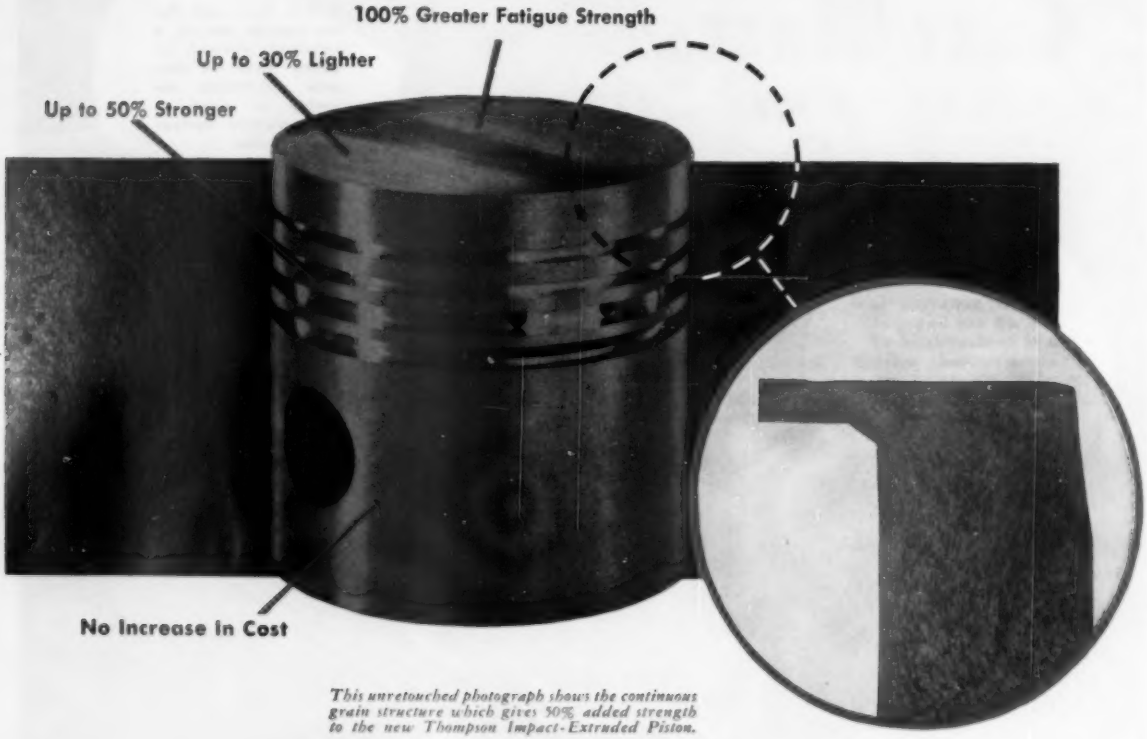
THOMPSON PRODUCTS ANNOUNCES A NEW IMPACT-EXTRUDED PISTON



This unretouched photograph shows the continuous grain structure which gives 50% added strength to the new Thompson Impact-Extruded Piston.

THE all-new Thompson Impact-Extruded Piston is the first lightweight piston especially designed and engineered for all automotive engines. This new piston will soon be available to manufacturers of piston engines.

Made by an impact-extrusion method, this new piston is heat treated for higher tensile strength, greater ductility and 100% increase in fatigue life.

For over 50 years Thompson Products has been designing and precision manufacturing automotive parts to the closest tolerances known to the industry. Constant metallurgical research and experimentation join with this design and manufacturing to bring this new, lighter, stronger piston to the automotive builder at no increase in cost.

For complete information on this newest Thompson development, write, wire or phone Light Metals Division, Dept. PM-3, Thompson Products, Inc., 2269 Ashland Rd., Cleveland 3, Ohio.

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PMM

Precision Metal Molding

Nov. 1955

Volume 11 Number 11

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FEATURE ARTICLES

31 **DESIGN FOR APPEARANCE . . .** from drawing to chromium plated zinc die casting.

32 **RECOMMENDED MELTING PRACTICE FOR SMALL HEATS,** Part One. An outline of general and specific problems encountered in investment casting.

34 **WORKING PARTS FOR POWER TOOLS MADE FROM IRON POWDER.** A review of three interesting components of a radial saw. (Cover Story)

36 **HIGH SILICA GLASS . . . STABLE MOLD MATERIAL FOR CASTING METAL.** A report on a new method of precision casting.

38 **DESIGNING FOR DUAL USE.** A way to cut down on die costs.

41 **FLUXING PRACTICE FOR ALUMINUM ALLOYS.** Some pointers for melting.

43 **PRECISION LEAD CASTINGS AT LOW COST.** Unique casting and finishing of toy gyros.

44 **ADDING COPPER TO IRON POWDER COMPACTS,** Part Two.

47 **ELIMINATE MILLING . . . THE MOST EXPENSIVE OPERATION.**

81 **A CHOICE OF CASTING METHODS FOR ENGINE PARTS.**

FINISHING SECTION

51 **COLOR BOOSTS ADDING MACHINE SALES**

58 **HOW TO COLOR ANODIZE ALUMINUM**

REGULAR DEPARTMENTS

8 Between the Lines
10 Recent Patents
16 Data in Ads
22 Casting About
27 News About People
28 Opportunities
62 New Products
67 Useful Literature
86 Industry News

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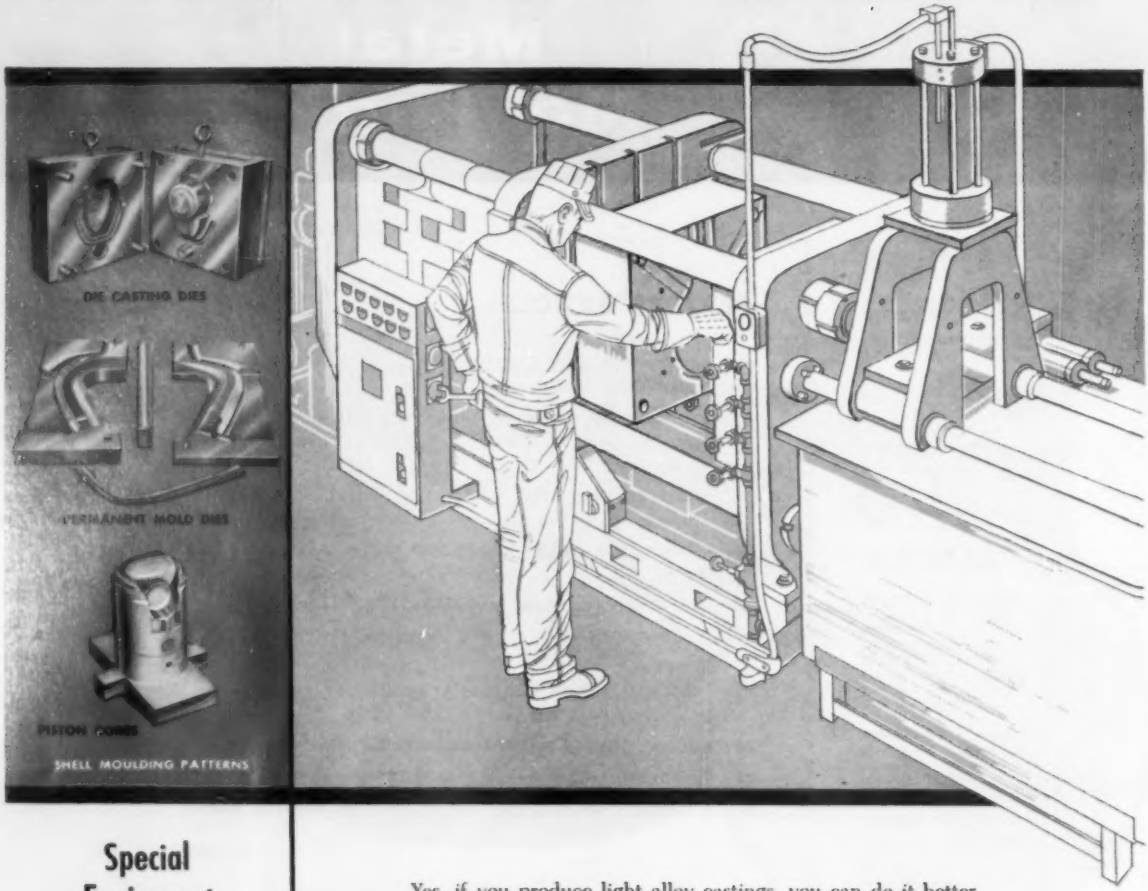

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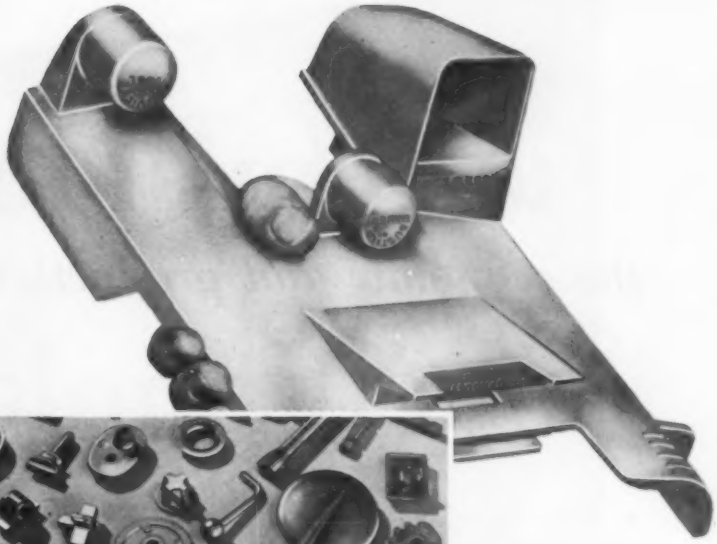

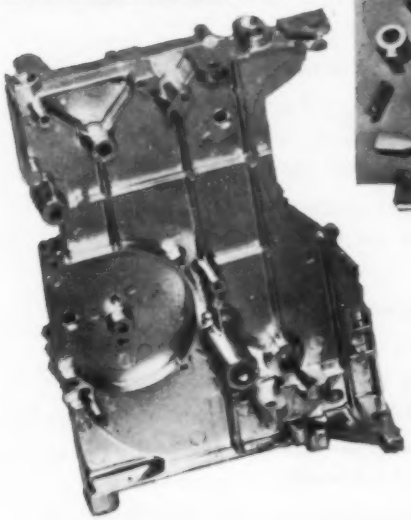

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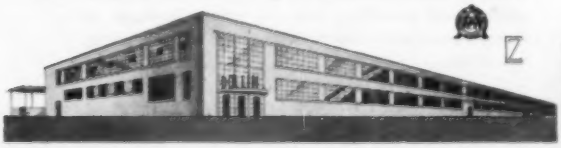

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a reminder of

the economic and production advantages of

shell molding

1. Molds are dry and porous, permitting quick elimination of gases; minimum back pressure is built up.

2. Very accurate dimensions are obtained; tolerances of a few thousandths of an inch are possible.

3. Very smooth surfaces can be obtained on cast pieces, and considerable machining is eliminated.

4. Fewer surface defects and smoother surfaces result in stronger castings, allowing thinner sections.

5. Uniformity of resin-sand mix in molds eliminates rejects caused by variations in moisture and clay content in usual molding sand.

6. Cleaning of castings is minimized and shot blasting is practically eliminated.

7. Some parts which formerly had to be made in two or more pieces to allow for machining may be made in one piece because of the reduction in the amount of machining needed.

8. Saving of metal by elimination of risers, by more efficient coring, etc., results in a much higher yield from metal used than customary.

9. Contamination of casting surfaces is held to a minimum.

10. More molds per day can be made with the same labor and space than by usual methods.

11. Handling of sand is greatly reduced; only about 5% of the usual amount of sand is used.

12. Handling and storage of flasks are eliminated.

13. Unskilled labor can be used for making the precision molds.

14. Molds have no affinity for water and may be stored indefinitely.

15. Cores being hollow and dry allow quick escape of gases; also, they collapse readily.

16. More castings per unit of floor space can be poured at one time because molds are smaller and are poured in upright position.

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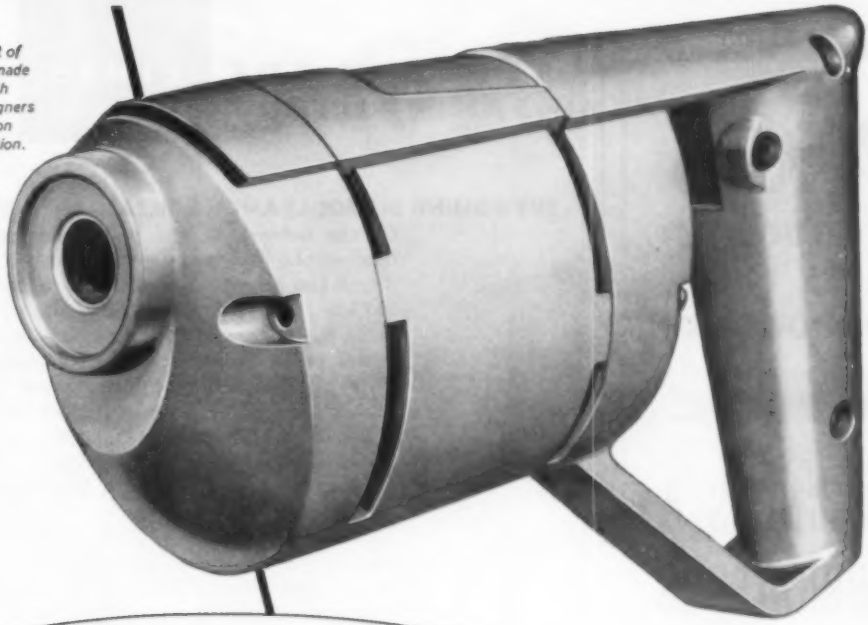

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BETWEEN THE LINES

THE COMING STRUGGLE AMONG METALS to provide components for the automotive and household appliance industries will be fought not only on the basis of price-per-pound and physical properties, but also on the *finishing line*. The cost of applying a finish can be many times the basic cost of the casting or stamping, and therefore, is a prime target for cost reduction studies. Now, a number of new finishes and finishing techniques are coming into production lines which may prove to give the margin of difference in the choice of designers who are considering zinc, aluminum and steel as possible alternatives. Vacuum metallizing, a newer development in applying bright finishes, was introduced recently to PMM's readers. In this issue, we present an article on *color anodizing of aluminum*, a process which the editors of PMM feel may have major impact on automotive design and also on the increased use of die cast aluminum within the next several years. The article begins on page 58.

BETWEEN BUYER AND VENDOR OF CASTINGS, there are many areas of negotiation and agreement with regard to quality control. Such questions as: When are deviations from the print necessary? What inspection should be required and by whom? Should the buyer approve the vendor's tooling? What should the buyer check on first samples? A major paper dealing with these and many other phases of the buying of investment castings will appear in three parts, beginning in the December issue of PMM. We feel that this article by Charles Yaker of Misco will be *must* reading for all castings buyers.

C-CLAMPS BY POWDER METALLURGY illustrate the physical properties attainable using conventional metal powder fabricating techniques. This is one of three new and unusual applications of powdered metal parts in the manufacture of a radial saw presented in an article beginning on page 34 of this issue. Besides the ability to compete with machined bar stock on a cost basis, powdered metal parts are also being used increasingly *where properties of wrought materials are needed.*

PRODUCT STANDARDS have become increasingly important, not only as a means of establishing a common language between supplier and purchaser, but also as a means of cutting costs by avoiding non-standard practices and implementing product design. In December, PMM will present *new material on product standards pertaining to die castings and powder metallurgy.* The sixth in a series of design standards from the American Die Casting Institute will be published, (followed by others in subsequent issues) and a data sheet from the Metal Powder Association correlating all available standards pertaining to powder metallurgy.

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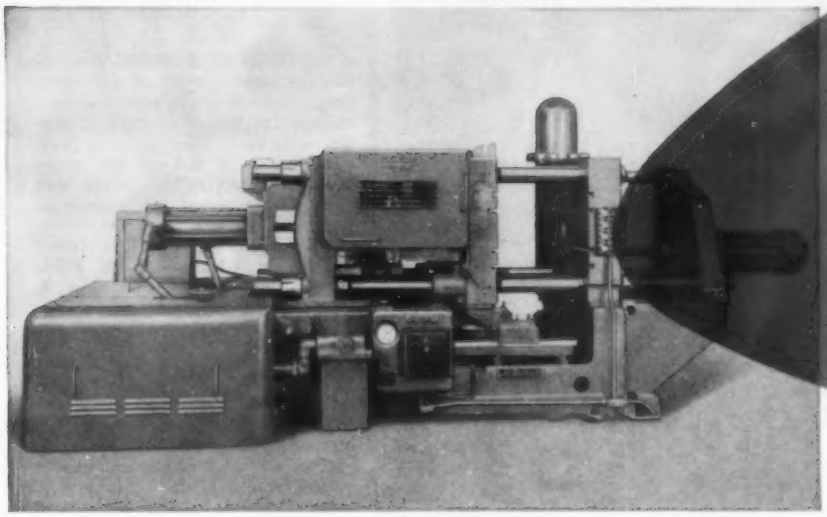
DIE CASTING MACHINES



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2
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A review of recent U.S. PATENTS

A METHOD OF JOINING pre-sintered shaped bodies of refractory oxide together while retaining their shapes. The bodies are held in contact with each other under a pressure of from ½ to 1 ton per square inch of contact surface while they are at a sintering temperature in the range of 1400C to 2000C.

(Patent No. 2,717,225—Sintered Refractory Mass — Albert Etheridge Williams — issued Sept. 6, 1955)

A DIE CASTING MACHINE with an interlocking hydraulic system. The controls operate at a low pneumatic pressure to actuate the mechanism which operates under high pressures.

(Patent No. 2,717,433—Metal Casting Machine—Paul J. McGervey, Jr.—assigned to The Richardson Co.—issued Sept. 13, 1955)

A PROCESS FOR PREPARING a complex fluoride salt of titanium, specifically potassium fluotitanate, K_2TiF_6. Potassium fluoride is added to an aqueous solution of hydrofluoric acid and titanium tetrachloride is added to the resultant liquid. The potassium fluotitanate is then crystallized out of solution.

(Patent No. 2,717,197 — Complex Fluoride Salts of Titanium—Gerald Taylor Brown, assigned to Peter Spence & Sons, Ltd.—issued Sept. 6, 1955)

A METHOD OF CHEMICALLY PLATING the interior of a hollow container with nickel. The container can be made of copper, silver, gold, aluminum, iron, cobalt, nickel, palladium and platinum. The plating solution used is of the nickel cation-hypophosphite anion type having a predetermined composition that is characterized by a high plating rate at a temperature within a given range near the boiling point of the solution.

The container to be plated is rotated about a horizontal axis and is at least partially filled with the plating solution. The solution is continuously circulated through the container to be plated at a rate that will maintain both temperature and composition within limits.

(Patent No. 2,717,218 — Chemical Nickel Plating Methods and Apparatus—Paul Talmey and Wm. J. Crehan, assigned to General American Transportation Corp.—issued Sept. 6, 1955)

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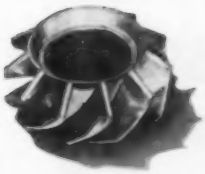

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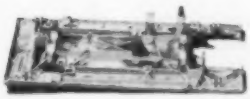

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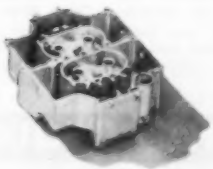

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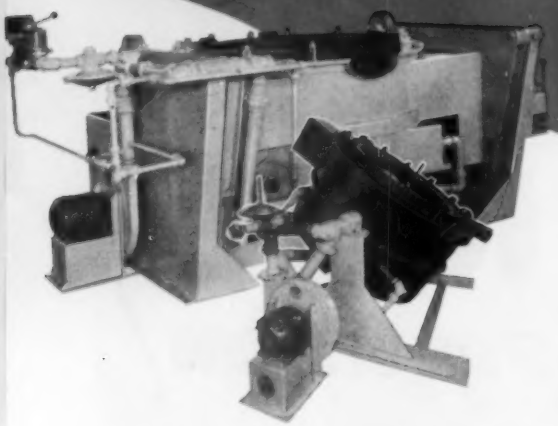

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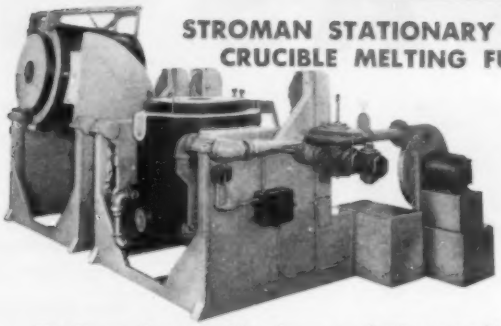

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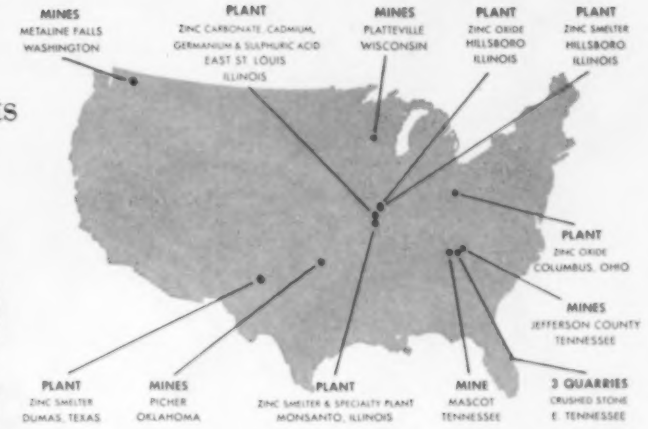
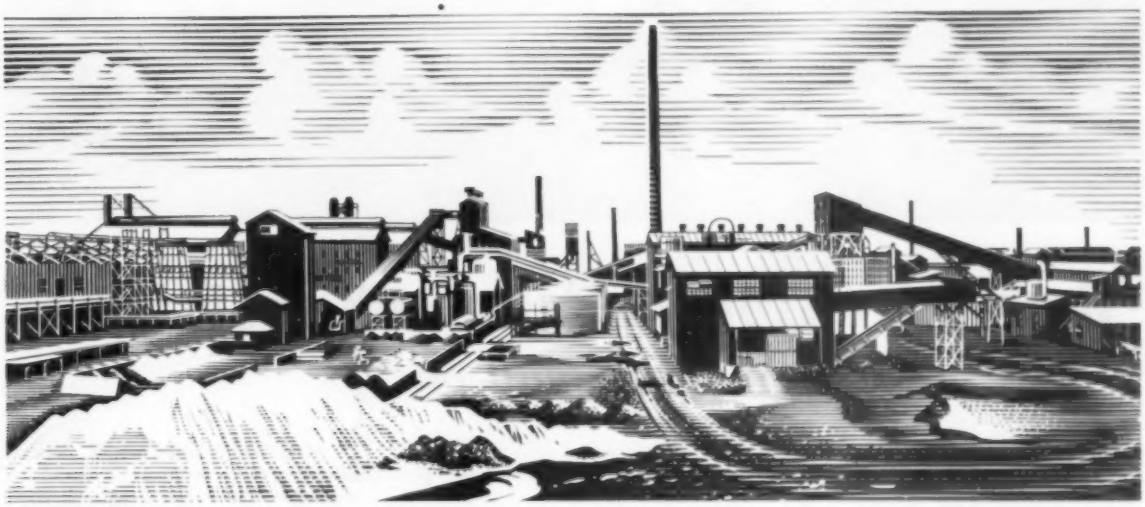
American Zinc and its products *from* A *to* Z





FAIRMONT CITY, ILLINOIS
(East St. Louis)

Operations include: roasting and sintering of zinc concentrates; cadmium plant producing commercial balls, sticks and plates; zinc carbonate plant; germanium plant producing germanium dioxide for the electronics industry. Sulphuric acid is produced by both the Chamber and Contact methods. For complete picture of American Zinc operations, see map above.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

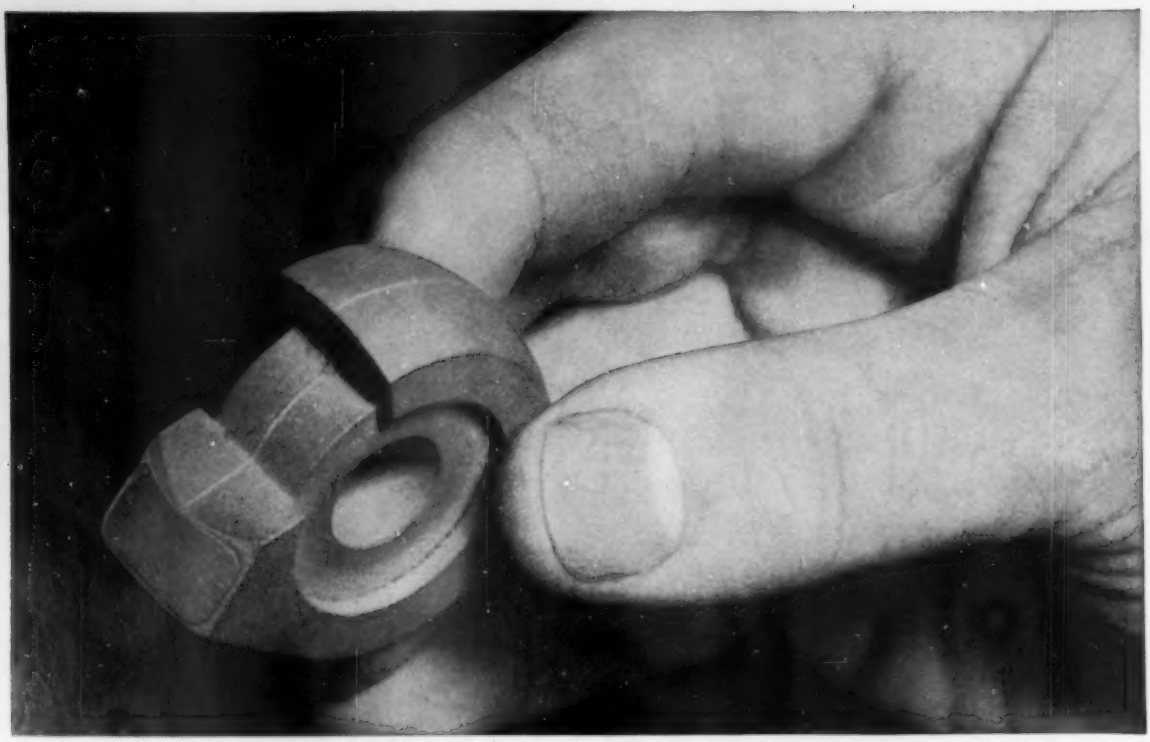
Distributors for

American Zinc sales Company

AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

For more information circle No. 8 on the Reader Service Card



How precision casting cut costs 84%

on this small part

Camco, Inc., of Houston, Texas, specializes in oil field equipment.

They produce a gas lift valve which can be installed in, or removed from, an oil well without pulling the tubing.

Inside the valve is a latching cam to lock it in place. And that little part caused Camco expense and trouble — until they came to Inco.

The part had to be resistant to oil well corrosives — strong to take the pressures — hard so that it wouldn't gall, seize or change shape despite years of exposure to corrosion, abrasion, shock and pull.

One metal they tried was hard enough, but too brittle. And costs to machine the part from bar stock seemed out of line.

Camco, already using Inco Nickel Alloys — Monel* nickel-copper alloy and "K"* Monel age-hardenable nickel-copper alloy — for other parts of the valve with good results, decided to consult Inco on this one.

Inco engineers recommended precision investment castings in "S"* Monel hard-grade nickel-copper cast alloy.

The price of the finished cam, including the cost of drilling and lapping, cut Camco's cost on this part 84 per cent!

Can You Cut Costs with Inco Precision Castings?

Whenever you have a part which is 6 inches x 5 inches or smaller, weighs under 3 lbs., requires starting tolerances as close as plus or minus .005 inch per linear inch, and needs 5 or more fabrication steps, there's a good chance you can save by having it precision cast.

What Alloys Can Be Precision Cast?

You may obtain precision castings from Inco in many metals and alloys, from plain carbon steel to the new super alloys. And no matter what metal you specify, you get many advantages.

Seven Advantages of Precision Casting

Precision castings may save as much as 60 per cent of production costs. (Savings like Camco's are unusually high.) They also make possible the use of extremely hard metals. Reduce machine shop bottlenecks. Lead to economies through redesign. Reduce metal scrap. Often permit the use of a higher alloy which otherwise would be too costly. Even make possible designs you previously thought impractical to produce.

*Registered Trademark

Get This Helpful New Booklet

Trying to keep costs in line on some small part? Then write for new 16-page booklet, "Cast to Outlast." Contains many case histories detailing how others cut costs with Inco precision castings. There is a good chance this helpful data will suggest a practical way to cut your costs, too.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO

Inco Castings

. . . Precision, Sand, Centrifugal

For more information circle No. 38 on the Reader Service Card

NOW . . . fire-resistant hydraulic fluids at the viscosities you need—

Celanese*

CELLULUBE*

SAYBOLT SECONDS @ 100° F.

90 150 220

The new Cellulube series of fire-resistant hydraulic fluids — in 3 viscosity ranges — clears the way for many new applications.

In addition to fire resistance and excellent lubricity, Cellulube hydraulic fluids have the following advantages:

non-corrosive	low volatility
controlled viscosity	thermal stability
non-foaming	high boiling point

In the die-casting field, Cellulube 150 and 220 are already standard hydraulic fluids. Now Cellulubes find applications in . . .

furnace combustion controls in steel mills and oil refineries . . . coke ovens, furnace tilters, loaders and ingot carriers . . . electrical welders, extrusion presses, forging and multiple action presses.

Your Celanese representative will be glad to give you full details. Or write for samples and technical data to:
Celanese Corporation of America,
Chemical Division, Dept. 589-K
180 Madison Avenue, New York 16.

Celanese* CHEMICALS

*Reg. U. S. Pat. Off.

HYDRAULIC FLUIDS SPECIALLY ENGINEERED FOR SPECIFIC APPLICATIONS

For more information circle No. 17 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

3. DRY FILM LUBRICATION can make major production economies possible. Bulletin 426 P-10 and reprint DC, both from Acheson Colloids Co., describe materials of this type, their uses and applications.

5. BRONZE PERMANENT MOLD castings that offer outstanding advantages to the designer are fully discussed and all pertinent data given in the new catalog from Alcaloy, Inc.

12. TECHNICAL DATA, free samples and descriptive literature on the fluxes for zinc die casting alloys can be secured from Atlantic Chemicals & Metals Co.

15. METAL DATA BOOK and catalog for the investment caster and other users of small batches of metal has been published by the Cannon-Muskegon Corp.

16. FASTER DIE SET UP that is also easier and safer is described in the latest catalog to be issued by Cast-Master, Inc.

17. FIRE RESISTANT HYDRAULIC fluids will do much to improve plant safety. The Celanese Corp. of America has full technical data available on their Cellulube, a material of this type.

19. A BROCHURE FOR ENGINEERING and production executives has been prepared by Cleveland Tool & Die Co. It shows how to lower production costs by having men with know-how make your tooling.

20. A COMPLETE DATA FILE on stock and special die and mold components has been prepared by the Detroit Mold Engineering Co.

24. COMPLETE INFORMATION on dry hearth, side dip-out furnaces is contained in engineering bulletin No. C-80 available from Eclipse Fuel Engineering Co.

25. JET BLACK FINISH for steel, copper and zinc is possible with the Ebonol. Technical data and advise are available from Enthone, Inc.

29. DIE LUBRICANTS for die castings are completely described and technical and use data given in bulletins that are available from Fiske Brothers Refining Co.

32. ZINC & ALUMINUM FLUXES for more efficient dross separation are described in a bulletin from Haviland Products Co.

33. THE HENNING MESSENGER, the house organ of Henning Bros. & Smith, Inc. gives information on metals and alloys, new applications of die castings and information about the company.

35. HOOVER DIE CASTINGS, a booklet that has been issued by the Hoover Co. describing their die casting facilities and giving some information of aid to the designer.

36. SOUND DIE CASTINGS require both high locking pressures and high injection pressures. The new machine by Hydraulic Press Mfg. Co. has both these requirements and some 40 other new features that are described in bulletin No. 5400.

38. HOW TO REDUCE COSTS through the use of investment castings is the thesis of a new 16 page booklet that has been published by the International Nickel Co.

40. INDIRECT ARC MELTING furnaces for small and medium sized melts are described in literature on the type PT tilting furnace from Detroit Electric Furnace Div. of Kuhlman Electric Co.

42. PRECISION CONTROL of melts for die casting and similar operations is best accomplished with induction heating. In bulletin 560, Lindberg Engineering Co. describes these furnaces and their advantages.

43. DESIGNING FOR DIE CASTING is made simpler and results are surer by following the tips given in a booklet from Litemetal Dicast, Inc.

50. REDUCE DIE COSTS by hobbing when ever possible. A booklet, "How and When to Hob" has been prepared by Newark Die Hobbing & Casting Co.

52. DESIGN AROUND STOCK sized bushing and bearings to lower production costs. A complete listing of these stock sizes is available from National Molded Products Co.

54. PRODUCTION OF INTRICATE parts can often be simplified and the costs reduced through the use of plaster mold, non-ferrous castings. An illustrated brochure about the process and some of the many castings made is available from Ohio Precision Castings, Inc.

56. MEN & COMPANIES WITH SPECIALIZED skills can generally reduce production costs. How this can be done to the cost of casting dies and molds is told in a catalog from Permanent Mold Die Co., Inc.

59. POSITIVE LOCKING is one of the first requirements of a die casting machine. Literature now available from Reed-Prentice Corp. describes this and other features of their machines.

63. AMORPHOUS TYPE SILICA in micron sizes for the investment casting industry is described and the chemistry and physical properties given in data sheets from Tamms Industries.

64. IMPACT EXTRUSIONS in aluminum to form such articles as automotive pistons is a new development of Thompson Products, Inc. Information on the process and its possibilities is available.

65. TECHNICAL ADVISE AND INFORMATION on the proper use of fluxes and the best flux to use is available from Rossborough Supply Co.

68. INJECTION MOLDING machines for the economical production of plastic parts such as patterns for investment castings are fully described in information published by Van Dorn Iron Works Co.

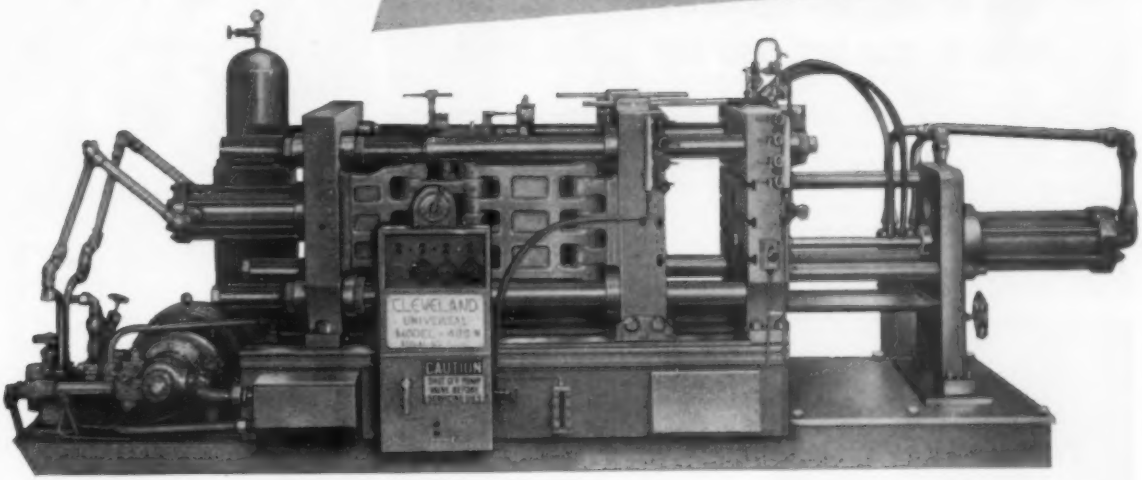
69. STAINLESS STEEL POWDERS, their advantages, applications, etc. are given in technical data available from Vanadium-Alloys Steel Co.

70. BARREL FINISHING can be simplified by using the Abbot Method. Details on methods, equipment and supplies are available from The Abbott Ball Co.

Continued on page 19

Meets *ALL* your requirements for *PROFITABLE* die casting!

Cleveland Model 400-N
shown with cold chamber end.



The CLEVELAND model 400-N
Hydraulic Universal Die Casting Machine

Here are the features of the Cleveland Model 400-N that will give you better castings, faster, at less cost:

- Massive, rigid construction throughout for dependable, economical performance.
- Powerful die locking pressure — 400 tons, strain gauge tested.
- Rapid, smooth die closing and opening for high production operation.
- High metal injection speeds to produce sound, dense, hardware finish castings.
- Safe, simple control—manual or automatic.
- Ample room for die mounting, for operation and maintenance.
- Universal construction — easily convertible for either hot or cold chamber operation.

To get the most from your die casting department —in speed of production and quality of castings —investigate the many advantages of the Model 400-N Cleveland. Let the Cleveland sales engineer in your area show you how the Model 400-N can improve your die casting production with money saved . . . or write direct for full details.

REMEMBER, CLEVELANDS CUT COSTS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

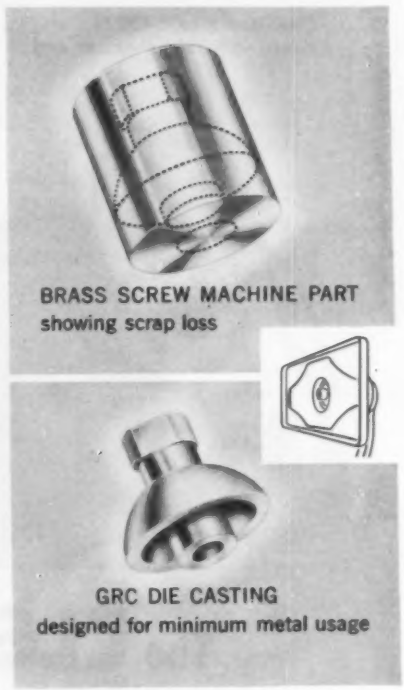
Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information circle No. 18 on the Reader Service Card

SMALL MIRROR PART REFLECTS 66% SAVING: GRC DIE CASTING ELIMINATES SCRAP LOSS

Brass screw machine part made from bar-stock meant big scrap loss, high cost; Gries die cast part means no scrap loss; costs only 1/3rd as much!

This rear view mirror component was an expensive part of the assembly when made of brass because so much costly metal was completely lost in machining (see diagram). Gries' die casting of the same part completely eliminates the scrap loss. In addition, Gries' design flexibility permitted casting the part with a "material-saver," for further cost reduction. The brass part actually was 3 times more costly than the Gries zinc die cast part!



BRASS SCREW MACHINE PART
showing scrap loss

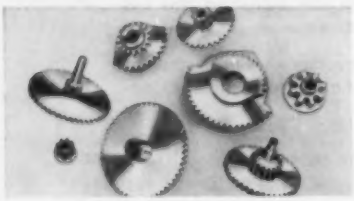
GRC DIE CASTING
designed for minimum metal usage

GRC's exclusive die-casting methods produce finished tiny parts, trimmed, ready-for-use, in one high-speed automatic operation . . . at low, *low* tool cost. The rear view mirror part is being die cast less wastefully, less expensively, and more uniformly, at high production rates.

Gries' unusual techniques and special facilities permit almost unlimited design latitude. No part is too small — maximum weight, ½ ounce; maximum length 1¾ inches. Economical mass production — from 100,000 to many millions — assures lowest costs.

Send for your copy of Gries' new, informative Die Casting Bulletin.

GRC DIE CASTS GEARS AND PINIONS IN ONE PIECE FOR LOWER UNIT COSTS



Lower cost, improved design, faster production is possible because GRC gears and pinions are die cast in *one* piece. These one-piece zinc alloy assemblies can be die cast with shafts or center holes, or in combination with cams, hubs, spacers, flanges, etc. Many combinations are available from stock dies for less precise applications at no tool charge. Special designs and close-tolerance requirements are produced at nominal tool charges.

Maximum size of Gries' gears and pinions is 1-5/16" O.D. x 1/16" face width; on the smaller diameters wider faces can be furnished. They are available in quantities from 100,000 to millions. Write for catalog sheet, samples.

GRC MAKES WIDEST RANGE OF WING NUT TYPES AND SIZES

Mass produced in the widest selection of stock sizes to fit all cost and application requirements, GRC wing nuts are also available in many types to meet unusual requirements. These include wing nuts with high, low or narrow wings to meet space limitations — and with serrated base for locking action in many applications. All have finger-grip recessed wings, exclusive with Gries.

GRIES HAS COMPLETE FACILITIES FOR SECONDARY OPERATIONS

In most cases, Gries' die cast zinc alloy parts need no secondary operations. However, GRC has full facilities for tapping, threading, drilling, reaming, special machining and assembling, when needed. Gries' finishing department has special mass-production facilities for the application of surface finishes to small die-cast parts. Special methods are used for most commercial finishes, including electroplating, barrel-finishing and chemical treatments.

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

GRIES REPRODUCER CORP.

157 Beechwood Ave., New Rochelle, N. Y. NEw Rochelle 3-8600

For more information circle No. 31 on the Reader Service Card

DATA IN ADS
continued from page 16

71. COMPLETE ENGINEERING DATA on the use of Iridite for finishing zinc, cadmium, copper, aluminum and magnesium parts are now available from Allied Research Products, Inc.

72. MAINTAIN DIMENSIONAL tolerances and precise detail of contour and surface through the use of barrel finishing methods. Literature on the process and equipment is available from Almco.

73. FOR PAINTING PARTS where masking is either required or desirable, Conforming Matrix Corp. has equipment that will lower finishing costs. Literature on masks and associated equipment is available.

74. FASTER TUMBLE FINISHING, as much as 25 percent faster, is claimed for barrels and abrasives described in literature from the Grav-i-Flo Corp.

75. THREADED INSERTS for use in soft metals to take the wear and stress of assembly, vibration, etc. are fully described and typical examples of use given in a descriptive folder from Groov-Pin Corp.

76. GRINDING, POLISHING & buffing machines as well as most other types of finishing machinery utilizing abrasives are described and illustrated in catalog No. 60 from the Hammond Machinery Builders, Inc.

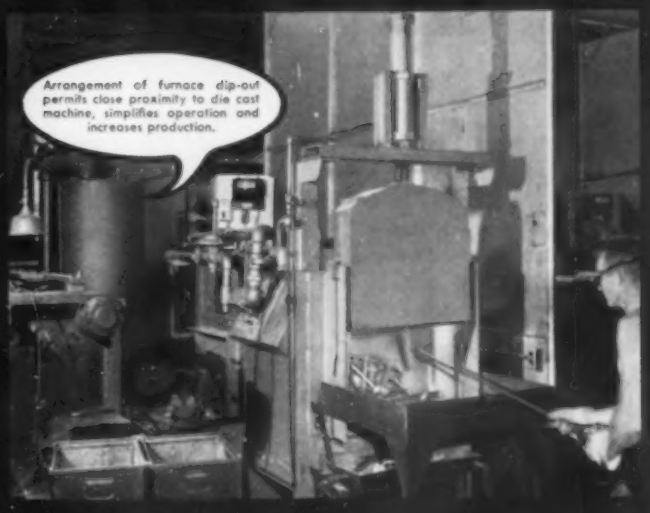
78. METAL CLEANING & surface preparation are discussed in a booklet "Some Good Things to Know About Metal Cleaning" that has been published by Oakite Products, Inc.

79. MOLDS & DIES are cleaned and surface finished easier and faster with Hydro-Finish. A bulletin, No. 1403, from the Pangborn Corp. describes the methods and equipment.

82. SURFACE FINISHING methods that maintain dimensional accuracy while doing a fast, economical job are described in a catalog from the Roto-Finish Co.

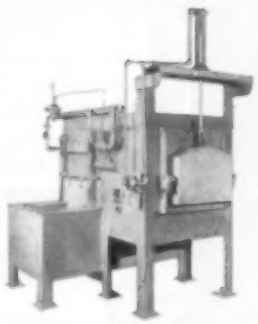
85. COPPER PLATING on zinc base die castings by the Unichrome copper process is only the first step in the process for chromium plating. Details on copper, nickel and chromium plating die castings are available from United Chromium, Inc.

NEW ADVANCED METHOD FOR MELTING ALUMINUM


Arrangement of furnace dip-out permits close proximity to die cast machine, simplifies operation and increases production.

Newest Eclipse Furnace Joins 20 Year Veterans... Still On The Job!

• Madison-Kipp Corporation, Madison, Wis., has installed its thirty-fourth Eclipse aluminum melting furnace purchased over a 20-year period. This indicates that Eclipse furnaces offer the day-in, day-out reliable performance demanded by a large-volume maker of aluminum castings.


Dry hearth, side dip-out furnace

The newest furnaces are Eclipse Dry Hearth Soft Metal Melting Furnaces, fired by propane gas and arranged for side dip-out. Operating temperatures range from 1120 F to 1250 F with the average operating temperature at about 1180 F. Separate melting and holding chambers provide constant pouring temperatures and improved quality control. Cold metal is preheated and melted on the sloping hearth so only molten metal enters the holding chamber. This method eliminates gas pickup and oxide inclusions and results in higher quality metal.

Eclipse builds aluminum melting furnaces for a variety of production arrangements. They are available with end dip-out, side dip-out, or double side dip-out in capacities from 300 to 2000 lb of metal per hour.

Eclipse

For complete facts, write for new Bulletin No. C-80

ECLIPSE FUEL ENGINEERING CO., 1123 Buchanan St., Rockford, Ill.

Eclipse Fuel Engineering Co. of Canada, Ltd., Don Mills, Ontario

For more information circle No. 24 on the Reader Service Card

SAMMY INGOT "DELIVERS A PACKAGE"

IN THIS ONE GREENFIELD PACKAGE YOU CAN ALWAYS COUNT ON OVER-NIGHT DELIVERY AND PROMPT SERVICE ON YOUR INGOT ORDER — AND FREE FOUNDRY CONSULTATION WHENEVER NEEDED...
CASTING HELP
DELIVERY SERVICE

... AND OUR INGOTS ARE CHEMICALLY PURE, EXACT AS SPECIFIED — AND WE HAVE A LARGE INVENTORY OF ALL WANTED ALLOYS - MOST IMPORTANT - GREENFIELD PRICES WILL KEEP YOU COMPETITIVE.
THAT'S THE PACKAGE WE WANT!!!
S
LARGE INVENTORY
EXACT SPECIFICATIONS

"OUR INGOTS MAKE BETTER CASTINGS"

SAMUEL GREENFIELD ALUMINUM ALLOYS

- Chemically Pure
- Rigidly Supervised and Tested
- Certified Chemical Analysis Furnished

FREE FOUNDRY ENGINEERING CONSULTATION SERVICE

Over 120 years combined experience is yours at no obligation. Write or call . . .

SAMUEL GREENFIELD CO., INC.

HUmboldt 4050

31 Stone St. Buffalo 12, N. Y.

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Precision temperature control of the three Lindberg-Fisher furnaces is maintained through these conveniently grouped panels.

From left to right, Robert W. Scott, Virgil L. Shoemaker and Del T. Kay, general partners, SKS Die Casting Company.

"Outstanding Improvement"

IN CASTING METHODS WITH LINDBERG-FISHER INDUCTION FURNACES

● SKS Die Casting Company, Berkeley, California, is engaged in critical close dimensional work in casting fuel cell fittings for aircraft. To achieve consistent results extremely close control of metal temperature is essential.

Mr. Del T. Kay, SKS general partner, says: "We had no previous experience in induction melting and holding and sought the best advice we could find. As a result, we have installed three Lindberg-Fisher two-chamber Induction Melting Furnaces. These fulfilled our requirements completely and represented an *outstanding improvement* over our previous methods."

Like SKS, you will also find that Lindberg-Fisher Induction Melting and Holding Furnaces provide these advantages: cleaner molten metal, continuous production, cooler operation and minimum maintenance. Ask us to recommend the proper type of furnace for your particular needs or write for our Bulletin 560.

LINDBERG-FISHER MELTING FURNACES

LINDBERG ENGINEERING COMPANY, 2463 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS

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SERVING INDUSTRIAL AMERICA

★ QUALITY
★ SERVICE
★ DEPENDABILITY

Manufacturers of
Aluminum Alloy Ingots
Zinc Alloy Ingots

ALLOYS & CHEMICALS
MANUFACTURING CO., INC.

4365 Bradley Road
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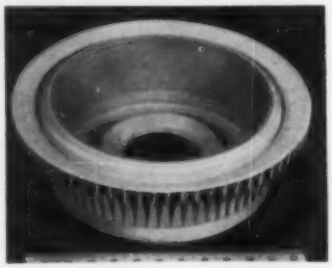
ONtario 1-8600

CASTING ABOUT

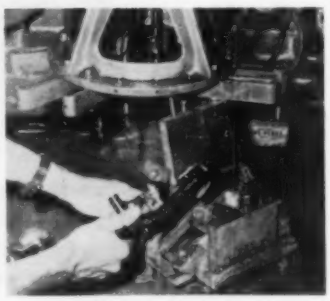
NICKEL IRON BRAKE LINING bonded to a permanent mold cast aluminum brake drum by the Al-Fin method gives excellent braking action to the European sports car, Mercedes-Benz model 300 SL. According to Inco Nickel Topics, a 0.80/1.00 percent cast iron nickel cast iron containing molybdenum and chromium, bonded into the aluminum drum, is especially effective for braking at high speeds and under heavy loads. Energy of the speeding car is absorbed by the brake and dissipated to the air in the form of heat.



The brake drums are cast by Karl Schmidt Works of Neckarsulm, Germany, a sub-licensee to the Al-Fin Division, Fairchild Engine and Airplane Corp. So successful have these bimetallic brakes proved that Daimler-Benz A.G. has adopted this type of brake drum on its entire model 300 SL passenger car series.

TOOL STEEL CLINICS held once a week over a period of six weeks attracted 300 Northeastern Ohio engineers and operating men during September and October. The clinics, held in Cleveland by Crucible Steel Company of America, covered: die casting die steels and plastic molds; cold heading and shock tools; metal forming, stamping and trimming dies; high speed steels for single and multiple point cutting tools; hot working die steels; and practical heat treatment of tool steels. Speakers came from several of Crucible's branch offices, and were described as "down to earth" sessions designed to appeal to tool and die makers, designers and engineers, as well as others needing practical knowledge of tool steel applications.

STEEL AND PLASTIC mixed together in proportions of about 80-20, has been introduced as a versatile tool and die maker's material by Chemical Development Corp. The material, called Devcon, is available either as a putty-like material or a liquid. Two hours after the addition of a special hardening agent, the material is said to become rigid, tough, strong and steel-like, capable of being sawed, threaded, drilled or ground with regular metal-working equipment.



Typical application, shown here, is a set of fixtures made by Triangle Tool & Die Company for a national stove and appliance manufacturer. These fixtures hold metal castings during various machining operations as well as buffing and assembling. One unit was made in 30 working minutes, compared with six hours machining.

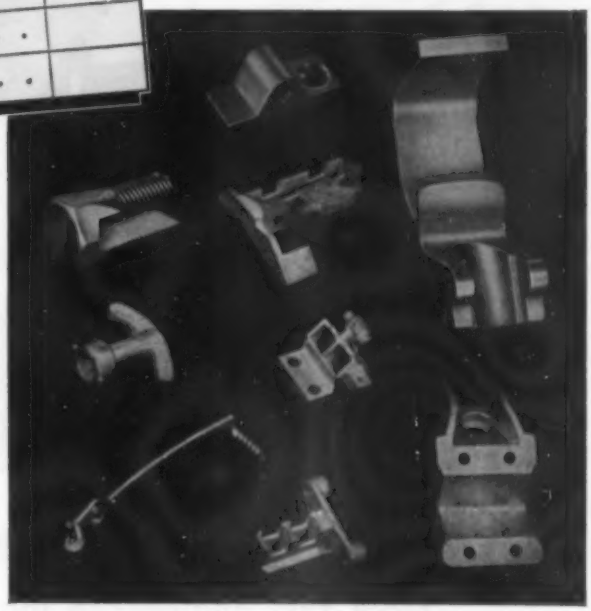
NEW ZIRCONIUM ALLOY called Zircalloy is reported by Westinghouse Electric. Most impressive property is its resistance to corrosion when exposed to high temperature, high pressure water in nuclear reactors. In one year, only 0.0001 corrosion can be measured.

VACUUM CLEANER SALES this year may climb above the 3 million mark for the fourth time in the industry's history, according to figures released recently by C. G. Frantz, president of the Vacuum Cleaner Manufacturers' Association. Other years were 1947, 1948 and 1950 when part of the sales volume came from accumulated consumer demand resulting from wartime suspension of cleaner production. The majority of household vacuum cleaners make important use of die cast components.

Continued on page 24

DOES YOUR COMPONENT PART REQUIRE:	
1. COST REDUCTION	
2. HI-STRENGTH	
3. CORROSION RESISTANCE	
4. MANY MACHINING OPERATIONS	
5. THAT IT BE MADE FROM BRASS, BRONZE, OR ALUMINUM	
6. IMPROVED APPEARANCE FOR SALES APPEAL	
7. INTERLOCKING PARTS	
8. HIGH-STRENGTH BEARING QUALITIES	

If you can check one item on this list, send us your blueprints for estimating . . .



We'll prove to you

ALCALOY

can save you money on

COMPONENT PARTS

We have a new permanent mold casting process and an exclusive bronze alloy that team up to give you a big cost reduction advantage in your products. Keep these facts in mind when you're designing and planning production.

Alcaloy castings are uniformly close-grained, clean, sound and free from cavities and surface flaws. All dimensional tolerances are held within specifications. This means low machining costs, less scrap, less shop equipment. First costs of castings often are lower than other types.

Our special bronze alloy is non-sparking, non-magnetic, corrosion-resistant and light gold bronze in color. It remains free from tarnish and pitting. Some grades have the strength of steel and hardness of C 35-40. This alloy is valuable in safety tools, machine parts, chains, fittings, utensils and many other products.

We are increasing our facilities to insure prompt delivery on component parts. Send us blueprints or return the coupon below for the complete, money-saving Alcaloy story.

ALCALOY, INC.
P. O. BOX 503 TRENTON, NEW JERSEY
ASSOCIATED WITH DICKEY INDUSTRIES

* ACCURATE INSPECTION INSURES UNIFORM QUALITY

Every phase of Alcaloy production is supervised by experienced metallurgists. We are licensed by U. S. Atomic Energy Commission to use Cobalt 60 in testing castings for internal flaws. You can depend on Alcaloy quality.

Send information on Alcaloy Casting Process ☐
Send new Alcaloy catalog ☐

Name _____ Title _____

Firm _____

Address _____

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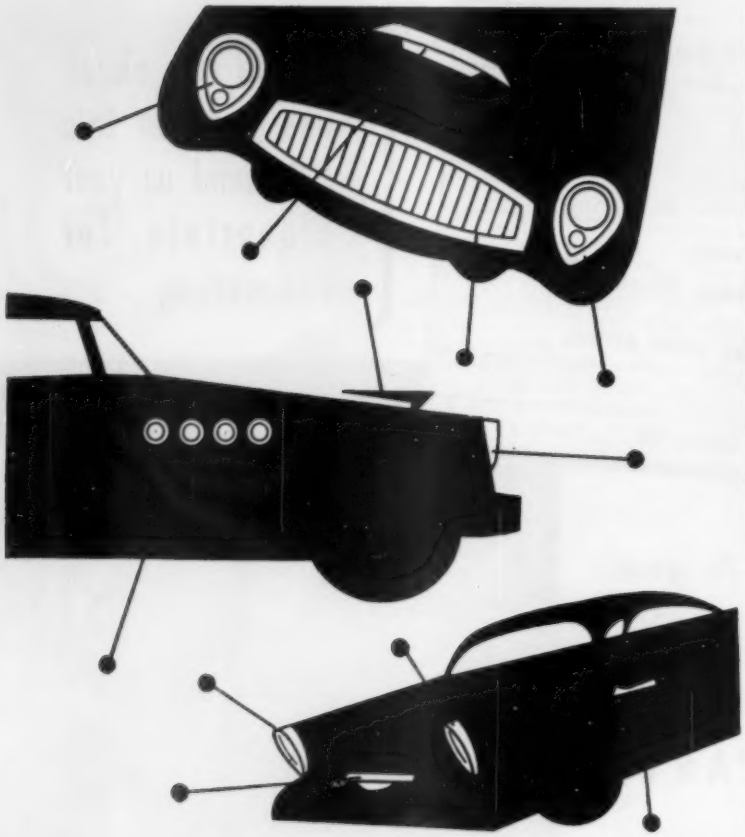

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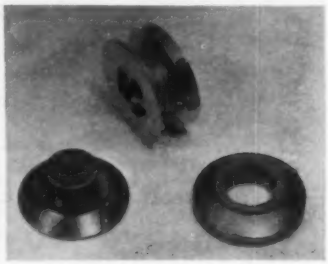
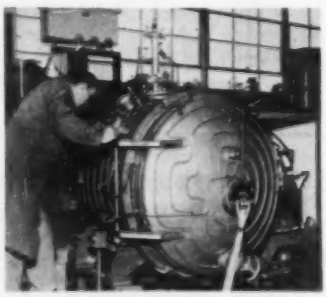
CASTING ABOUT
continued from page 22

THE WAY TO MAKE A VEE is illustrated by this vee-shaped wheel which guides and supports the broiler tray of Tappan Stove Company's Diamond Jubilee "Greenbrier" model domestic range. Powder metallurgy has been the most economical method of forming this piece. Brockway Pressed Metals, Inc., compact the wheel in two parts, as shown in the foreground, each compact being made from a different powder mix. One has a



positive and the other a negative growth factor. The green compacts are fitted together and placed in the sintering furnace, where the reaction to heat produces a sintered union having the same strength as the parent metal. Iron powders, both produced by Plastics Metals Div., National-U.S. Radiator Corp., are used for these pieces. After sintering, the wheels are resin-impregnated and plated, ready for lifetime service.

TO EXTEND THE RANGE of investment casting alloys that can be cast and improve the properties of those already being cast, Austenal Laboratories, Microcast Div. has installed this vacuum melting furnace at its Dover, N.J., plant. Said to be the first such furnace designed specifically for investment casting, the



unit was manufactured by Naresco Equipment Corp. Melting of metals in vacuum is said to eliminate harmful gases and undesirable oxides and slag compounds.

The 6 grades of Die Slick

Here is brief information on the six different grades of Die Slick—more detailed information will be sent on request.

No. 3—Aids parting and ejection on difficult ALUMINUM and MAGNESIUM castings. Non-staining. Enables better metal flow and fill-out of castings.

No. 4—Expressly for BRASS castings —sometimes used on aluminum and magnesium. Extra heavy-duty compound with lubricating graphite. Retains lubricity under high heat.

No. 9—For clean "hardware" finish ZINC castings, where finest plating results are required. Assures maintenance of clean cavities, cores, ejector pins, and guide pins.

No. 11—General purpose compound for ZINC castings. Generally stain-free unless applied too heavily. Prevents sticking and scoring.

SG—Standard grade compound for general use on ALL alloys except brass. A high viscosity amber fluid that is not readily burned off by the heat of the dies.

PS—Plunger-Slick is an adherent viscous compound that will not melt under highest casting temperatures. Expressly for cold chamber machines, it prevents scoring, sticking, or wear on plunger parts. No. 21—(silver) for average use on all alloys. No. 34—(black) has added micronized graphite for extra high lubricity.

Don't shoot, Davy...try Die Slick!

Ole' Davy can shoot the spots out of the nine of diamonds at 30 paces, but this casting has him stuck. His podner with the Die Slick knows the motto: "Be sure you're right, then go ahead." Next time Davy will be sure . . . Die Slick *prevents* sticking, scoring, and soldering. It will not stain castings, so most cleaning problems end right there.

Unlike b'ar grease or pot-luck lubricants, each of the six grades of Die Slick is uniform from batch to batch, and each yields consistently excellent results. It doesn't cost much, especially when stacked up against the cost of needless rejects and damaged dies. Four out of five die casters use Die Slick regularly. Try a week's supply. Simply specify quantity and the type of alloy on which you will use it. If you're not satisfied, return the invoice unpaid.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

DIE SLICK

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EBONOL "S" Processes for blackening steel to produce jet-black oxide coatings. Simple and economical to operate. Operating temperatures: EBONOL "S", 285-290°F., EBONOL "S-30", 295-305°F.

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NAMES IN THE NEWS

Thayer Lindsley, founder of *Ventures Limited*, has announced that arrangements have been completed for **Robert B. Anderson**, who recently resigned as United States Deputy Secretary of Defense, to become president of the company.

John R. McCord has been appointed to the staff post of director of public relations, advertising and market research of *Ferro Corporation*. In this position he will co-ordinate these activities of the various Ferro subsidiaries and divisions.

Baldwin-Lima-Hamilton Corp. has announced the appointment of **John O. White** as sales engineer for the Foundry Department in the Philadelphia district.

Atlantic Compound Company has named **William R. McFarland** president and general manager.

Norman W. Calkins has been appointed assistant manager of tool steel sales and assistant to vice president **W. J. Long** by *Universal-Cyclops Steel Corp.* Mr. Calkins will make his headquarters at Cyclops Division, Titusville, Pa.

William M. Oliver has been appointed process development engineer at the Port Huron, Michigan plant of *Acheson Colloids Company*. Mr. Oliver replaces **Bart Dickey** who has been promoted to production manager.

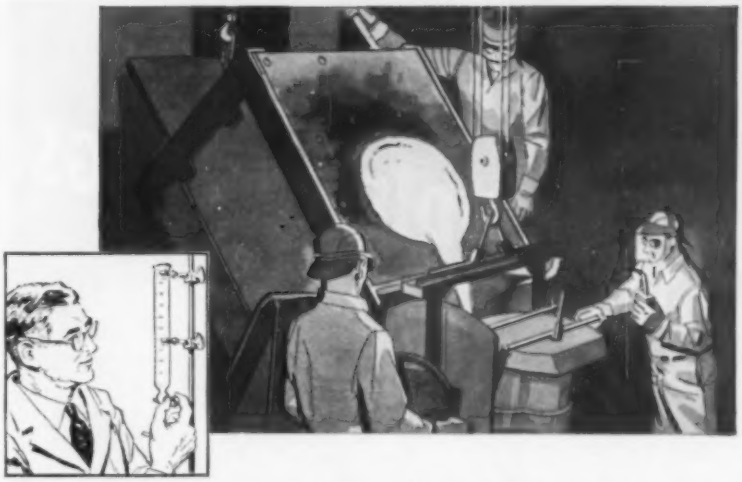
Edward L. Penn, formerly coreroom foreman at Pan American Alloys, Inc., has been appointed Shalco field service engineer in the Southwestern states by *Shallway Corporation*.

Vascaloy-Ramet Corporation announces that **Harris H. Robbins** has rejoined their organization as assistant district supervisor for the West Hartford, Connecticut area. Mr. Robbins will be responsible for all supervision and service work in this area.

Erwin J. Campbell has recently been appointed supervisor of process research, Research and Development Department, *Acheson Colloids Company*.

Henry H. Arnhold, president of *General Ceramics Corporation*, has announced the appointment of **John H. Bouwmeester** as vice-president of manufacturing and a director of the company. At the same time, the appointment of **James W. Schallerer**

Continued on page 80



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ACI TYPES	AMS 5388	SAE 6150	INVAR	CR-FE
17-4-PH†	PWA 651A	SAE 8630	TOOL and DIE STEELS	
		SAE 3140		

†ARMCO Steel Corp. *International Nickel Co.

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HOW TO GET SOUND DIE CASTINGS

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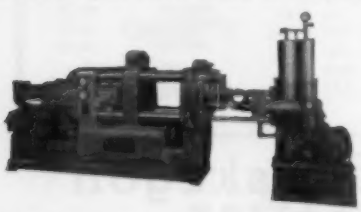
Here's why H-P-M's new die casting machine makes better castings: new positive clamping action is achieved by sliding wedges driven by knuckle-joint linkage which preloads the press frame and backs up the platen. The results . . . a minimum of flash . . . sound castings.

In this new H-P-M clamp mechanism there are no toggle pins under heavy shear load . . . no single line contacts . . . and no extremely high stressed members that normally result in high maintenance cost and down time.

These are just a few of the 40 new and improved features of the new H-P-M die casting machine. Write for Bulletin 5400, a completely illustrated story on this H-P-M line of profit makers.



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ENGINEER—Mechanical or metallurgical engineer to train for control of entire investment casting process. Steel and/or non-ferrous experience desirable but not essential. East Coast. Box PMM 171, 221 W. 41 St., New York City 36, N. Y.

FOR SALE—Die casting machine, Hydropress, type 2, 150 ton, 14" ramstroke, 30" opening. Machine in good condition. Now in operation. Contact R. J. Thomas, Redmond Company, Inc., Owosso, Michigan.

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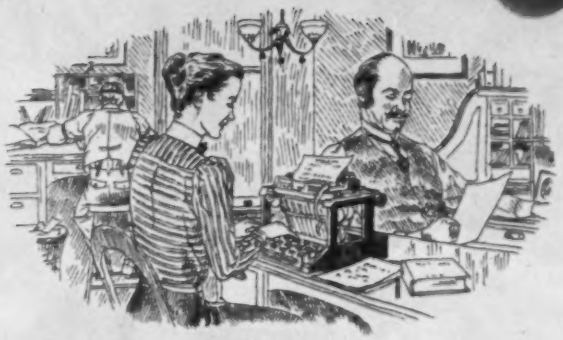
This was our calling card...



50 YEARS AGO

Yes...exactly fifty years ago, the skillfully cast piece of zinc shown above in actual size was the ingenious calling card used by our founder, Carl J. Moberg, to tell potential customers about the new die casting business he had just started at Mount Vernon, N. Y.

The legend it carried was significant—and prophetic. On one side it reads:

Cast by C. J. Moberg, Inc. Reliable Die Casting. And on the reverse:

We cast intricate parts finished in steel dies.

Write us before you make patterns, buy costly tools, or order elsewhere.

If we accept your order, we guarantee satisfaction.

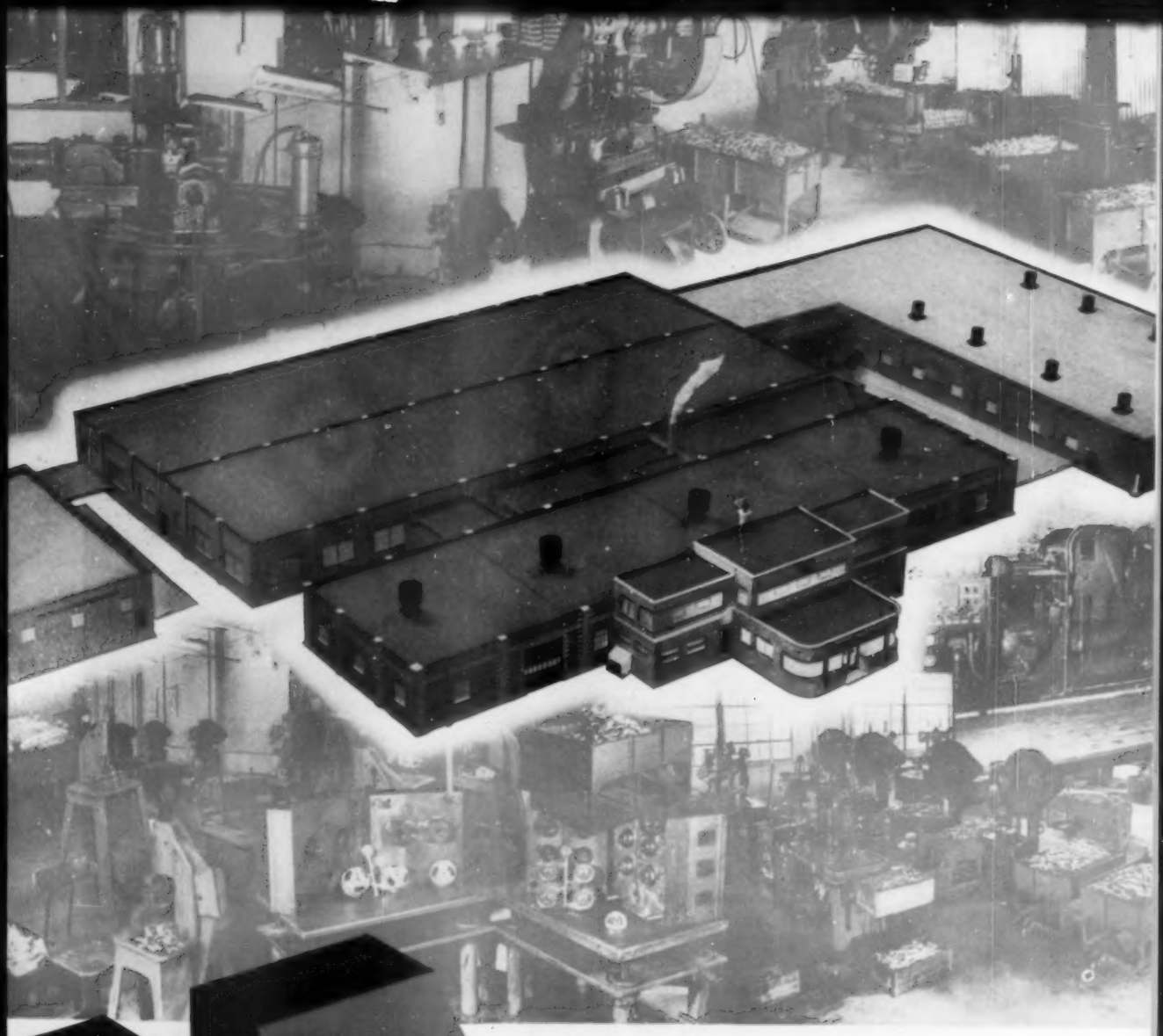
It is superfluous to point out at length how greatly the world around us has changed since Carl Moberg handed out his "calling card." On country roads, horses were still prone to rear up in terror at the occasional automobile. Carl Moberg never die cast a part for even so "commonplace" a product as an electric iron. There were none.

Nor could he foresee the enormously expanded physical facilities, in 1955, of the business he began—with our 165,000 sq. ft. of floor space, with our complete tool and die shop, our automatic electric furnaces, our forty die casting machines.

One basic thing, however, has *not* changed. It is the essential reason, we are sure, for Mount Vernon's growth. Carl Moberg indeed founded well.

"If we accept your order, we guarantee satisfaction."

MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT



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Design For Appearance

. . . from drawing to finished casting

1. CHROMIUM PLATED ZINC die castings give good service and appearance.

DISPENSERS for liquid soap and detergents exemplify a trend toward a combination of utility and pleasant appearance in sanitation equipment.

In designing dispensers of this type, the Ampion Corp., Long Island City, determines first the probable sales level for any given design. If it appears that the sales will justify, zinc die castings are chosen for as many of the metal parts as can be made by this process. This choice is based on many years of experience which have shown that, for the rough service and some times highly corrosive atmospheres encountered in industrial uses, a chromium plated zinc die casting gives excellent service at much lower cost than brass forgings.

From drawing to model . . .

The particular design finally made is not a happenstance. The unit is first laid out on the drawing boards; when an apparently acceptable design has been worked out, a clay model is made. This model is studied both from the esthetic and the utilitarian points of view and changes made.

From model to pattern

The design is then re-drafted and from these drawings, a wooden pattern of each metal part that is later to be die cast is made.

From pattern to sand cast

Using the wooden pattern, sand castings in brass are made and the new unit completely finished, including chromium plating. These finished castings are then turned over to the die casting foundry, in this case the Parker White-Metal Co., to make the necessary dies and start production.

From sand cast to die cast

If, at this stage, there are any casting problems, the die caster consults with the customer to make such modifications as may be necessary to produce the parts.

Because the Ampion Corp. prefers to do no machine work, but only assembly, all machining and sub-assembly are handled by the die caster. Plating is done by a job shop.

As can be seen from Figure 2, few second operations are performed on these castings. All holes are cored, including the mounting holes in the bases. Internal threads to take the glass bowls are cored so that the only actual machining operations done are fine threads on some of the valve parts.

Continued on page 79

2. DIFFERENT MODELS are also die cast in zinc, as indicated by these pendulum type dispensers and castings.

Recommended Melting Practice For Small Heats

Part One

By DR. NICHOLAS J. GRANT
Associate Professor of Metallurgy
Massachusetts Institute of Technology

The General Problem . . .

SMALL heats — Big problems. Most manufacturers of precision investment castings will agree with this statement wholeheartedly.

Before going into detail regarding recommendations for small heat practice, let us look at a number of the reasons why the problems are greater in small heat practice than in large heat practice. Furthermore, for the sake of simplicity and to have a common starting point, let us assume that either a master melt is available or wrought melting stock can be obtained.

1. One cannot analyze and test each small heat casting.
2. Losses of certain elements such as aluminum, titanium, silicon, beryllium, tantalum, columbium, zinc and others are generally high from:
   a. oxidation (aluminum, silicon, titanium, etc.)
   b. reaction with the crucible (titanium)
   c. volatilization (zinc)
3. Gas pick-up is rapid, including oxygen, nitrogen and hydrogen.
4. It is difficult to oxygen blow, to decarburize, or to inert gas flush to remove hydrogen without blowing metal out of the crucible.
5. Temperature changes take place too rapidly.
6. Estimating alloying element losses is difficult; weighing small amount of correction additions is subject to error; and unless pure metal can be used, the variation in composition from one batch or segment of a batch of ferro-alloy can be large.
7. Deoxidation for similar reasons is difficult to gage, to add efficiently, and to protect once it is added.

More reasons can, of course, be added easily, but those listed above serve adequately to illustrate a number of the more serious and damaging pitfalls.

Specific Problems From Individual Shop Practices . . .

We should now consider specific problems for a variety of shop conditions and try to assess the extent of the difficulty and subsequently recommend a means of minimizing the fault.

Melting Methods

The two most common melting processes are the *induction furnace* and the *carbon arc resistance furnace*, usually of the indirect type. Gas fired melting and electrical resistance methods for lower melting alloys are considerably more rare in the precision casting field.

If we first consider *induction melting*, there are the choices of current frequency and types of crucible to use. If graphite, carbon, silicon carbide or any conducting material is used, then the crucible acts as the susceptor and the *liquid bath will not be stirred* by the induction eddy currents and instead the charge must melt by conduction and radiation from the hot crucible. Normally such crucibles can only be used for alloys where:

1. the solubility for carbon is very low.
2. the alloys are generally of lower melting point than about 2000 to 2200° F.
3. there is little chance of segregation of heavier or lighter elements than the solvent metal.

Above temperatures of about 500 F, carbon and graphite burn but silicon carbide remains quite stable to temperatures near 2200 F in the presence of most liquid metals when decomposition of the SiC may occur. When the crucible is the susceptor the crucible must always be hotter than the metal. For very high speed melting this means hotter crucibles and greater danger of crucible contamination for the higher melting point alloys.

It is preferable to use the nonconducting oxide refractories with induction melting since a wide range of melting temperatures can be accommodated. Furthermore, the oxide refractories permit stirring of the molten bath, thus avoiding large temperature gradients and segregation of alloying elements.

The SiO_2 crucible should not be used if there is any danger of reaction with the molten metal or its alloying additions. This SiO_2 will react with titanium, zirconium, aluminum and beryllium; this will result in a loss of these elements and a pick-up of silicon

by the metal at high temperatures by reduction of silicon from the crucible lining.

The best commercial refractory for general use is MgO and this is followed by stabilized zirconia, which is, however, quite expensive. Alumina crucibles are quite strong and generally non-reactive with most metals but are more expensive than MgO and tend to crack more easily.

There is also an important choice of the frequency of the induction source. When one uses a large motor-generator set, the frequencies are usually low, (from 500 to 10,000 cycles and generally from 1000 to 4000 cycles). These low frequency units are characterized by the longer wave length current cycles and therefore heat more deeply, penetrating several inches into a bar of steel.

On the other hand, the lower the frequency the more difficult, if it is at all possible, to heat smaller metal particles of the better conducting (non-magnetic) metals such as copper and aluminum. The mercury-arc convertors and some smaller motor-generator units operate at intermediate frequencies, in the range of 25,000 to 40,000 cycles.

This article is based on a paper given by Dr. Grant before the spring meeting of the Investment Casting Institute in New York.

The air spark-gap units as a rule operate at frequencies from 100,000 to 300,000 cycles. The wave length is considerably shorter than for the low frequency motor-generator sets. As a result, these higher frequency units heat by means of a skin effect, the larger solid metal pieces heating by conduction from the hot skin zone.

Smaller metallic pieces such as fine scrap, fine shot and small cuttings and shearings will heat effectively, and the better conducting non-magnetic metals such as copper and aluminum can be melted. The stirring of the metal bath is considerably more subdued, but probably adequate for most purposes. Obviously the mercury-arc convertors and intermediate frequency units will perform intermediate to the motor-generator and the air spark-gap units.

Still higher frequency units of the radio tube variety can be had at frequencies greater than 500,000 cycles which also fit the pattern of effects indicated above.

Table I lists the effect of frequency on the current penetration of a low carbon steel above and below the Curie temperature (about 720 C or 1330 F).

Carbon arc furnaces are important in precision casting. They are inexpensive, upkeep is quite low, and operation is simple. One person can operate several at once. They are somewhat slower than induction units, but temperature control is generally easier to achieve. Oxidation losses are usually lower because of less exposure of the molten metal surface to an air atmosphere. Possibly one of the bigger problems is that of carbon control since both the atmosphere (high CO) and fine carbon spalling due to arc sputtering contribute to a carbon pick-up, which depends on furnace temperature, time of exposure of the melt to the arc, and alloy composition (high chromium heats will carburize more readily). In a 15 minute melting period it is not uncommon to experience a carbon pick-up of 0.05 to 0.10 in a low carbon stainless steel.

TABLE I

Current penetration in inches as a function of frequency.

Frequency Cycles	Below Curie (inches)	Above Curie (inches)
60	0.5	2.6
960	0.12	0.65
3,000	0.06	0.39
10,000	0.030	0.20
450,000	0.005	0.03

TABLE II

Affinity of metals for oxygen (in order of decreasing effect).

Group A High Oxidation Losses	Group B Medium Oxidation Losses	Group C Negligible Oxidation Losses
Calcium	Manganese	Iron
Boron	Chromium	Copper
Cerium	Zinc	Nickel
Magnesium	Tin	Cobalt
Beryllium	Carbon	Molybdenum
Aluminum		Tungsten
Titanium		
Zirconium		
Tantalum		
Columbium		
Vanadium		
Silicon		

Liquid Metal Reactions

Of the metals which are commonly melted or used as alloying elements in precision casting, we find that the affinity of the metals for oxygen should show the classification in Table II, decreasing effect going downward in each group.

This means that in any melting procedure it is wise to first melt group C elements since time and temperature have little effect on the losses. The next additions should constitute group B elements, and group C elements must be added either late in the heat,

1. as alloying elements, after thorough deoxidation and close temperature control, or
2. as deoxidizers prior to the addition of other elements in group C as alloying elements.

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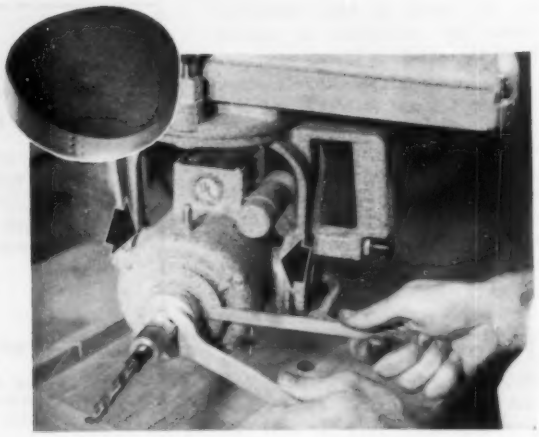


1. MOUNTING BOSSES on the sides of this motor housing are made of iron powder, brazed into position. Note simple shape of part shown in inset.

Working Parts For Power

Dozens of die castings go into DeWalt Saws

Electric motor components, end bells, rotors, frames, mounting brackets and related parts are among the many die cast parts used in DeWalt radial saws.

HOW powder metallurgy is becoming increasingly employed for purposes which sometimes have been regarded as either too simple to justify the tooling or too complex to be practical for this process is illustrated by a trio of components used in "DeWalt" radial power saws.

Mounting Bosses

Perhaps the simplest shape of the trio is the most significant. This component, Figure 1, is used as a round boss 2" in diameter, with one end concave to fit the curved exterior of an electric motor, while the other end is flat to fit against a trunnion which rotates in a yoke. Thickness of the boss varies from 5/16 to 9/16" due to the concave surface. This shape could be produced of any metal and by any process of casting, forging or machining.

Subject to appropriate variations in the method of attaching the boss to motor and trunnion, it could—for example—be made as an iron or aluminum alloy casting. Yet, careful analysis of the various possibilities shows why the DeWalt company preferred to have this part produced of powdered iron, pressed and sintered to specific density.

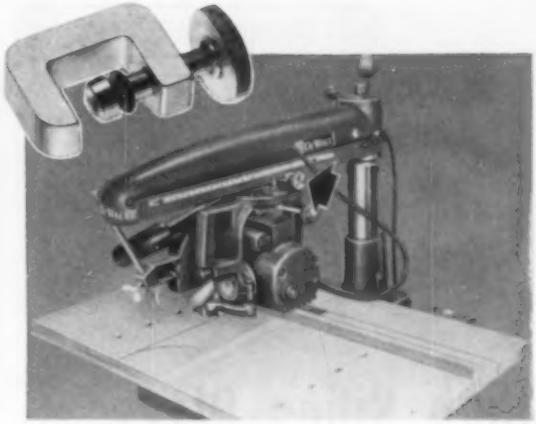
By having the boss made of ferrous metal, it is possible to attach it to motor and trunnion by the present process of silver brazing with induction heating. This is economical and it also assures adequate strength and permanence.

But even with the decision in favor of iron, the company might have chosen some process other than powder. Yet, here again the ultimate choice was relatively easy. It was found that no other process could produce the basic shape in iron and in the "medium-large" quantity desired with so low a first cost combined with complete freedom from any added cost for by machining.

Locking Pawl

The second item, Figure 2, is much more complex. It is a pawl,

2. SURFACE HARDNESS is a requirement of this locking pawl which holds the saw arm in position. It is a cadmium plated iron powder piece with shaft pressed in.



3. STRENGTH IS NEEDED in this U-clamp which is pressed and sintered iron powder, infiltrated with copper. Excellent performance is reported.

Tools Made From Iron Powder

used to fix the position of the radial arm of the saw.

At first glance, the pawl may seem to be almost as uncomplicated as the boss. But closer examination shows that the pawl has 10 exterior flat surfaces with only two planes parallel, four exterior curved surfaces, a through hole, and a blind hole.

Here again, with the quantity large enough to justify the original die costs of powder metallurgy, the choice was easy.

Several factors entered into the decision. The first was the company's desire for the part to have the surface hardness of iron; second was the desire for good appearance, and the third was the difficulty of machining the many non-parallel surfaces from a wrought or cast iron blank.

All of the exterior surfaces and the through hole are satisfactorily smooth and accurate as compacted without any machining. In contrast, if the iron had been sand cast, all surfaces would have needed finishing, the through hole would have required drilling or boring, and the blind hole probably would have required tapping.

As now produced by powder metallurgy, the pawl is not even marked by a parting line. Only one hole is drilled because it lies in a plane perpendicular to the motion of the die punches. In addition to its desired hardness and appearance, the powdered iron pawl has proven to be the lowest in total cost.

Screw Clamp

Strength, rather than the degree of shape complexity, is the outstanding feature of the third component, Figure 3. It is the U-section of a screw clamp used to fasten the saw assembly at any desired position on the radial arm.

Considerable pressure can be created by turning the screw in this clamp, and a corresponding stress resistance is required in the U-section. Ordinarily this might suggest having the section forged of steel or malleable iron. But either of those processes not only would have a higher original cost; they would also involve a secondary cost of machining.

In contrast, the section as now formed by powder metallurgy requires no machining other than drilling and tapping to receive the screw. At the same time, in powder metal, the part has a more than adequate strength factor. To some extent this adequacy is due to the cross-section thickness of the clamp, ½ x ⅝", and to the fact that the screw's center-line is only ⅝" from the inner parallel line of the section. But also the component demonstrates how additional strength may be imparted to an iron powder base by alloying it with certain other metals. In this case the iron sintering is infiltrated with copper.

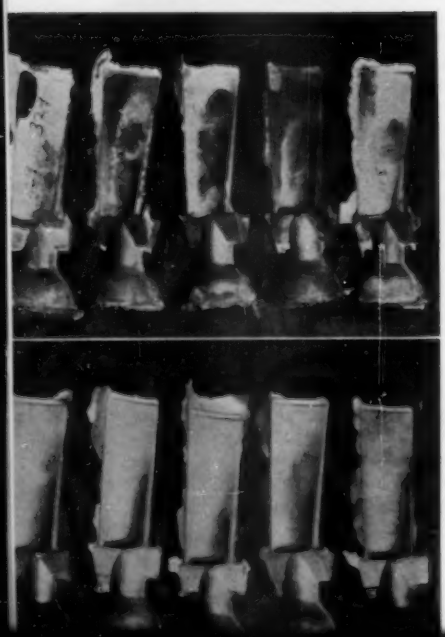
The C-unit and the pawl are cadmium plated. The bosses, however, are given a paint finish to match the general assembly. The DeWalt company, located in Lancaster, Pa., obtains these parts from Yale & Towne Mfg. Co. and Reese Metal Products Co.

TECHNICAL REPORT

High Silica Glass . . . Stable Mold Material For Casting Metal

1. WEIGHING AND SIFTING dense plaster from which the master pattern is made. It is then poured over a . . .

4. POURING A SLURRY of Glascast powder mixed with water. When a thick enough shell has been formed, excess liquid is poured out and mold dried . . .



GROUP OF FIVE JET BUCKETS, shown immediately after removal from the molds, top, and after a very light sand blast.

THE extremely low thermal expansion of Corning Glass Works' 96 percent silica glass is the basis for a new precision metal casting technique, using a fine mesh powder of this glass as the mold material.

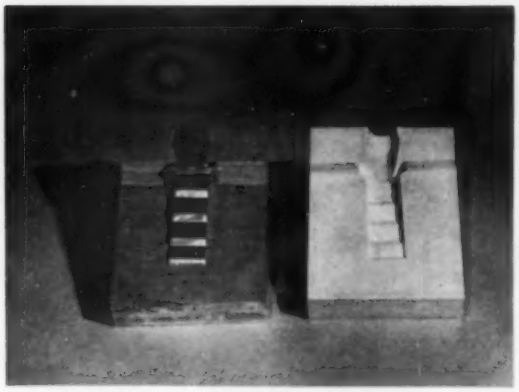
Some problems of dimensional control, surface quality and spalling or cracking of molds which plague producers of conventional investment castings are reported to be minimized by using this material with what is called the Glascast process for making metal castings.

The process has already been tried for pilot quantities of such critical pieces as jet turbine buckets. It yields surfaces that are essentially blemish-free, with better than 40 micro inch finish.

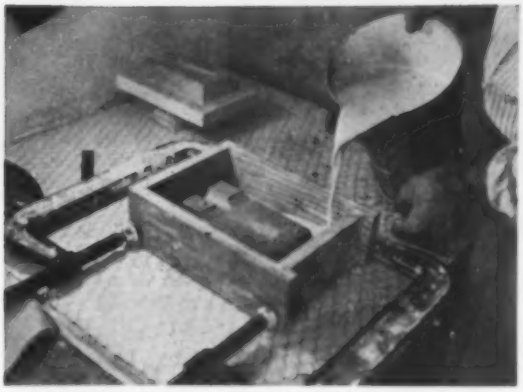
High chemical stability of the mold material and its inertness to reaction with molten metal or metal oxides eliminates a common cause of surface imperfections in investment castings.

How It's Done: Split molds are used, although some experimental work has been attempted with expendable patterns and monolithic molds, such as are used in investment casting. Greatest success however, has come from cope and drag.

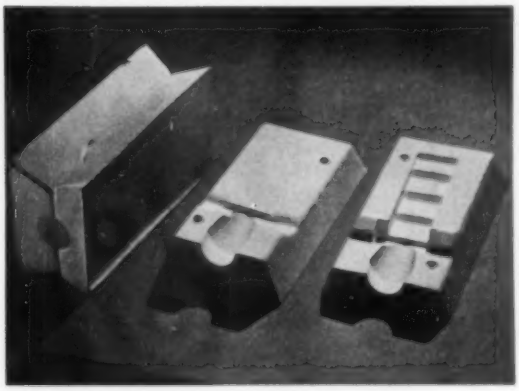
The molds for this process are



2. MODEL OF THE PROPOSED CASTING, shown here with the dense plaster pattern next to it. A frame is set around the pattern, and . . .



3. POROUS PLASTER MIX is poured over it. This makes the mold in which the actual Glascast mold is produced by . . .



5. READY TO BE ASSEMBLED and fired to temperature of 1920 F, after which the two-piece Glascast mold is backed up and is . . .

6. POURED WITH METAL. Low thermal expansion resists thermal shock, prevents spalling or surface defects on castings.

formed by pouring an aqueous slip of the Glascast powder into a porous plaster mold. The mold absorbs water, building up a shell of the glass material inside the mold. When the shell reaches proper thickness, the excess slip is poured out and the shell is dried.

The shell is removed from the mold and dried in an oven for a half hour. Mold halves are then paired and carefully fitted, and are fired to a temperature of 1920 F. Because of the excellent resistance to thermal shock possessed by this silica glass material, the cold, dry mold can be placed directly in the furnace operating at full temperature without preheating.

Now the mold is ready to be fastened together, backed with sand or shot, and poured. Mold preheating is not needed when casting aluminum, but for higher temperature materials, preheating temperatures may range above 1900 F.

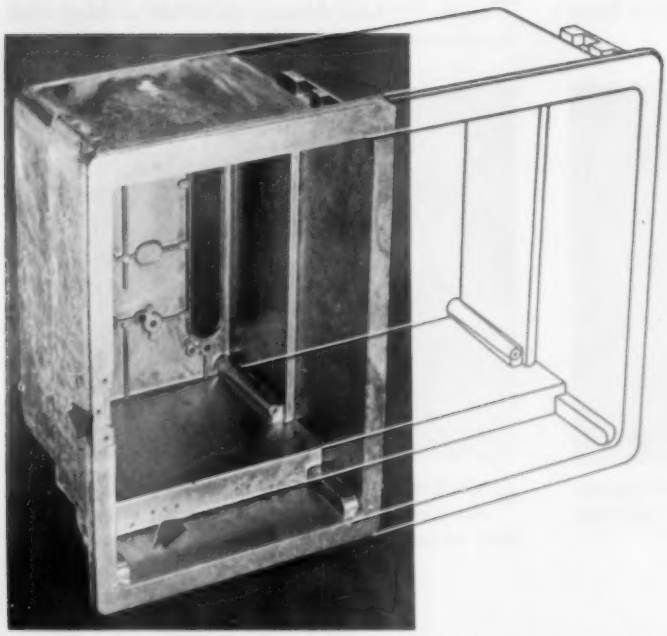
What Can Be Cast: Metals which have been poured in Glascast molds include not only the non-ferrous group, but also Stellite, Rexalloy, J-Alloys, X-40 Alloys and stainless steels.

So far, coring has not been tried and castings have been largely restricted to simple shapes possible within two-piece straight-draw molds, although there is no reason to believe that complex shapes would be impossible. Multiple section mold techniques commonly used in the glass industry could readily be adapted to the metal casting process.

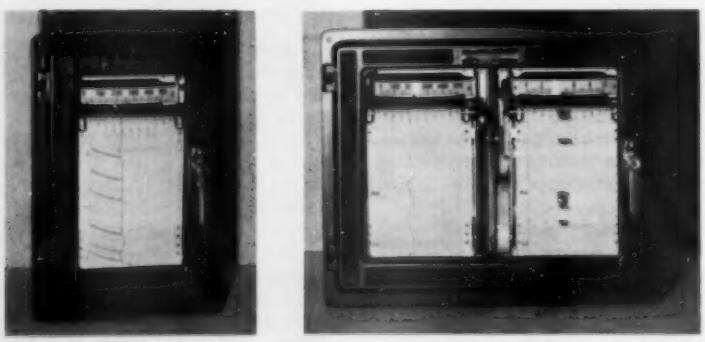
Biggest application of this process is believed to be in the field of "ultra precision" castings where loss in rejects for minor surface defects is a big problem. One of the major cost factors in pricing investment castings is the percentage of scrapped castings, commonly reaching 30-35 percent on castings where surface finish specifications are very close, as in jet blading. According to Corning engineers, test production of such castings has yielded 80-90 percent good castings using Glascast methods. *Continued on page 77*

TO CUT YOUR DIE COSTS HAVE YOU CONSIDERED

Designing For Dual Use?



1. SAW OFF THE FLANGE of two die castings, fasten them together, and you have the housing for a double instrument, thus extending the quantity of castings for tool amortization.



2. SINGLE OR DOUBLE instruments can be housed in the same die casting by using the alternative construction indicated in Figure 1.

THE cost of surface finishing a sand cast aluminum instrument case is usually a major expense item. Where the number of cases is not sufficiently great to justify cost of tooling for die casting, it may be that the manufacturer of the instruments must live with the high finishing costs.

In some cases, however, minor redesign of the instrument or careful study of the case casting will show how one general purpose case can be made to house a variety of instruments so that the economies of die casting can be realized.

Figure 1 illustrates how one casting can be used for several different applications. In the particular cases illustrated, the case casting was so designed that, by removing the flange on one side, it is possible to fasten two cases together to form the double unit.

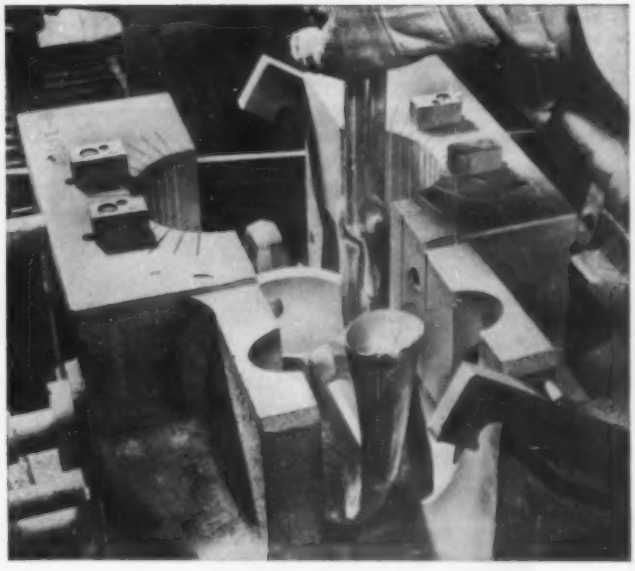
Because this particular application was envisioned when the casting was designed, adequate lugs were provided to fasten the two parts together. After the flange has been removed by sawing, an inexpensive milling operation straightens the cut edge so that when the two parts are bolted together and the surface finished there is no indication of a joint.

The use of two cases to form a single double unit is not, however, the only use made of this casting. In Figure 1. 10 center spots can be seen. These are provided for mounting some types of instruments that are not as widely made as others. The instruments fit the standard case, but need different mounting holes. With

Continued on page 40

use 'dag' dry films for trouble-free lubrication

dag DISPERSIONS®



Where scratching or scrubbing soon removes an ordinary die coating, 'dag' dispersions adhere to the die surface and provide clean and easy release, casting after casting. 'dag' Colloidal Graphite works into the pores of the die metal, giving a slick, adherent, permanent *dry lubricating film.*

A die-caster tells us that he has used 'Oildag'® – 'dag' Colloidal Graphite in petroleum oil – diluted in carbon tetrachloride to coat his molds, and eliminated pick-up from the molten zinc he casts at 900°F. He makes more than a thousand castings per mold before touching up the dies, and his production has been speeded up more than 200%!

You'll find a surprising number of ways to use 'dag' dispersions described in our free literature. Write today for Reprint DC and Bulletin No. 426-P10.

Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of carriers.

You get smoother castings, cleaner dies, with long-lasting 'dag' dispersions

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DUAL USE
continued from page 38

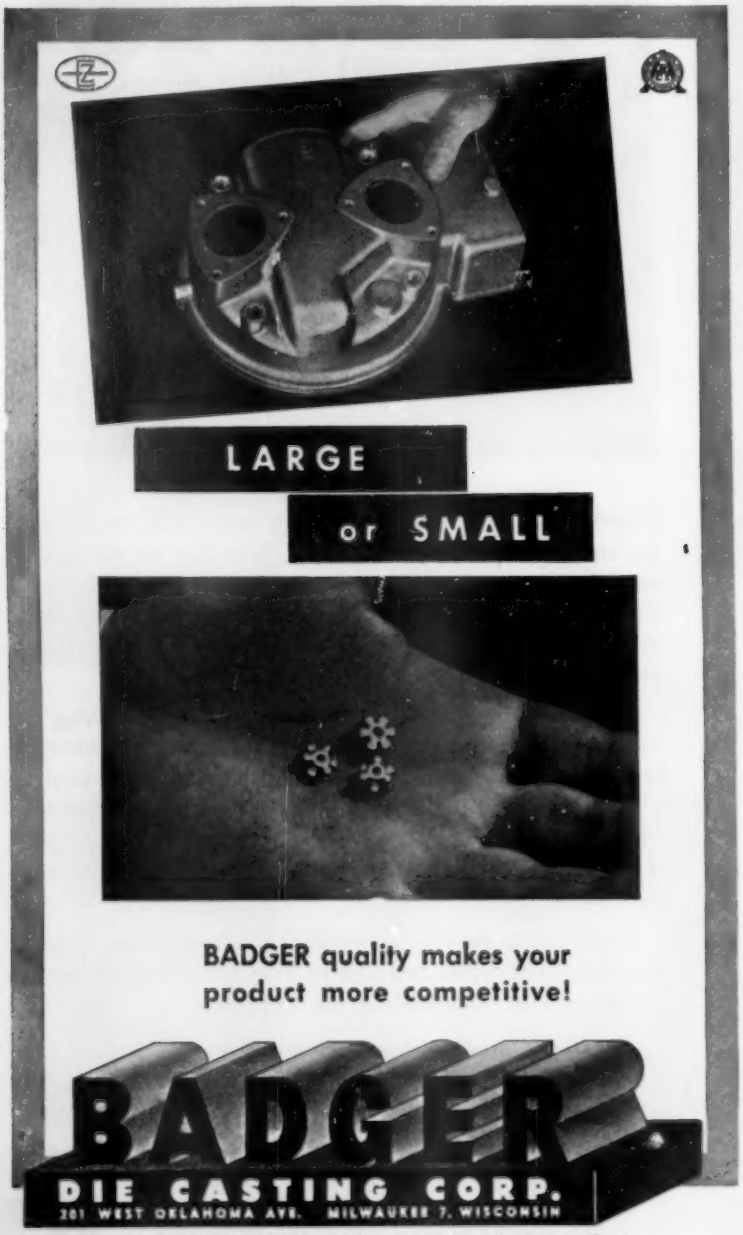
the centers spotted, it is a very simple and inexpensive job to drill the required holes. No jigs or fixtures are needed, only a fast press operation.

Thus, the application of a single casting is widened so that it can be used in sufficient quantities to justify the initial tooling costs for die casting and thus ultimately bring instrument case costs down by major reductions in machining and surface finishing costs.

Naturally, not all instrument cases used by Esterline-Angus Co. fall in the classes indicated above. For several types of instruments, both panel mounted and portable, the number of units produced is great enough to justify die casting the cases for these instruments. Such a case and cover are shown in Figure 3. Here, the case has been specifically designed for a given type of instrument and it is interesting to note that this same case has been in production since 1933.

3. FOR MANY YEARS, Esterline Angus has been using this pair of die castings to house panel-mounted instruments.

Except for very minor machine operations such as drilling small holes and tapping holes where threads are needed, the case is substantially ready for surface finishing as it is received from the foundry. Light surface sanding in a few places is sometimes needed, but little else. For this case, as well as for the larger one discussed above, the final surface finish is a baked black lacquer.



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HEAD OF BOUND BROOK OIL-LESS BEARING DIES

William Fisher Jennings, president and treasurer of the Bound Brook Oil-less Bearing Company, Bound Brook, N.J., passed away September 14th, at his home in Mendham, N.J. Mr. Jennings, associated with the Bound Brook firm for 41 years, was one of a small group of men who fostered from its infancy to widespread use today the technique of manufacturing bearings and other machine parts of metal powders.

Mr. Jennings gained considerable recognition by devising applications of the manufacturing process for use in cars and war material.

He joined the Bound Brook Oil-less Bearing Company in 1914, was named Eastern sales manager in 1917, vice president in 1919, treasurer and general manager in 1923, and attained the presidency in 1928.

WHETHER YOU MELT aluminum alloys as a caster or as a smelter, here are some useful and practical pointers on . . .

Fluxing Practice For Aluminum Alloys

By **WALTER N. ROSSBOROUGH**
Rossborough Supply Co.

10 REQUIREMENTS OF SATISFACTORY FLUXES

- Flux must hold melt loss to a minimum.
- Give perfect separation of metal from skim.
- Reduce surface tension to promote coalescence.
- Have higher specific gravity than aluminum.
- Be non-deliquescence.
- Add no harmful impurities to the alloy.
- Be easily charged.
- Be inexpensive.
- React to a temperature below 1250 F.
- Must not attack crucible or furnace linings.

ALUMINUM has a natural affinity for oxygen and hydrogen which makes consistent foundry performance very difficult. Founders using the best melting and handling practice sometimes produce metal which gives excessive scrap. To counteract these variables, most melting supervisors use one or more fluxes to improve and maintain metal quality.

Fluxes in great number have been formulated and sold throughout the years. Confidence in the supplier is a must, as it is almost impossible to check or analyze the product furnished. One cannot expect to learn from a supplier the exact proportions or components of a compounded flux, but any reputable supplier should be willing to state the active ingredients of his product. This allows use of the flux with the full knowledge that no safety regulations are being violated, and that no harmful additions are being made to the metal. Stringent safety laws and the necessity to adhere closely to specification in alloy content force the melter to know all additions to the melt.

We believe all fluxes can be classified into three major groups:

1. Reclamation
2. Degassing
3. Improvement

Reclamation Fluxes

These include those fluxes which are mainly used in the smelting operation. Many smelters have the problem of excessive metal loss when melting borings, turnings and other fine materials. This is caused by the difficulty encountered in getting the tiny globules of molten metal resulting from the fusion of the fine material to coalesce. This is due to the fact that each globule is surrounded by its own cover of aluminum oxide.

To promote coalescence, the melt can be held just above the fusion point and the globules coalesced by hand or mechanical puddling. The agitation which results breaks the oxide film and permits the globules to unite. This technique takes too much time and is costly.

As a result, many smelters use a cover flux or wet flux in amounts of 10 to 20 percent of the weight of the metal charged. Flux and metal are melted together. As these wet fluxes have a lower melting point than the alloy, they melt first and tend to prevent the metal chips and turnings from excessive oxidation. Usually a mixture of two or more chlorides are used for this type of flux.

The reason for the use of more than one chloride is that the melting point of each individual component of the flux would have a higher melting point than that of the aluminum, but when combined with other salts, a eutectic is formed which means that the compound will melt at a much lower temperature than any of its parts. For example, the melting points of sodium chloride and potassium chloride are 1474 F and 1428 F respectively. The eutectic mixture of these two salts melts at 1193 F. If calcium chloride which melts at 1414 F is added to the two previously mentioned salts in the eutectic ratio, the melting point of the three salts is 986 F.

Other smelters do not use a cover flux, but rely upon a flux which will melt or dissolve the skin of the oxide to produce globules which can unite. The advantage of this type of flux is that it eliminates the need for constant stirring and hence reduces labor costs. It also gives a considerably

Continued next page

FLUXES FOR ALUMINUM
continued on page 40

lower melt loss. The greatest efficiency and best recovery is obtained in aluminum alloy smelting by use of an ignition type flux. This type of flux melts when it is applied to the metal bath. This melting allows the flux to dissolve to oxide and permit the start of coalescence. Upon oxidation, the flux ignites, producing a powdery skim which further increases the separation of the metal from the skim. In most cases, in order to obtain proper ignition, a fluoride and some other salts in controlled percentages must be in the flux. The chloride salts do not promote ignition.

It is estimated that a satisfactory ignition type flux reduces aluminum in the dross raked from the furnace by more than 10 percent as compared to the wet cover flux method. Other advantages in the use of an ignition type flux over a wet or cover flux are that the finished alloy is freer of oxides and dross, furnace walls are kept cleaner, and dry skim provides a great deal less weight to be handled.

Ignition type fluxes are also used in foundry reverbatory furnaces and in foundry melting furnaces for the same reason. Even when clean metal is melted down, these fluxes reduce the metal content of the dross skimmed off the furnace and keep the walls of the furnace in proper condition. It is believed that the amount of metal saved by using the ignition type flux more than pays for the cost of the flux.

In some cases, when an ignition type flux is used on a pot or crucible type furnace and less frequently in a reverbatory furnace, proper ignition is not obtained. This is usually because the skim and the flux are not thick enough to provide a heat transfer barrier. The molten metal absorbs the heat as it is generated and prevents the skim from becoming ignited. If the skim or dross is raked into a thick layer or pile, there should be no difficulty in obtaining the proper ignition at normal foundry operating temperatures.

Degassing Fluxes

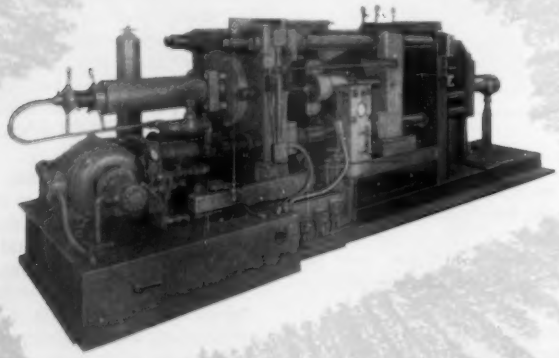
The solubility of hydrogen in molten aluminum is the reason that cast aluminum alloy products are prone to contain porosity. Molten aluminum, especially when the temperature is above 1350 F, will absorb hydrogen until an equilibrium condition is attained.

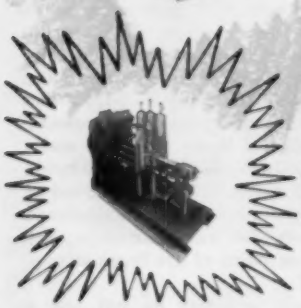
If the weather is humid, or if the products of combustion contain a large percentage of hydrocarbons, the molten aluminum will absorb a large quantity of hydrogen. If the reverse conditions exist, the gas level will be lower.

If the metal contains considerable dissolved hydrogen and if the solidification rate is slow enough, all of the dissolved hydrogen will precipitate out during the solidification and result in scattered spherical voids throughout the section of the casting. If the rate of solidification is rapid enough, some or all of the hydrogen will be retained in

Continued on page 74

Midwest-FOSTER
DIE CASTING MACHINES
FOR SOUND PRECISION CASTINGS





A NEW FEATURE! Midwest-Foster — Newly designed JET-SPEED — HI-PRESSURE injection end permits infinite adjustment of shot cylinder — easily and quickly up to 6 inches below center.

Other features include heavy framing and platens, positive clamping action, maximum injection speeds and pressures, hydraulic and electric interlock safety factors, minimum maintenance, all of which guarantee sound precision castings at lowest cost.

Injection assembly permits safe, efficient ladling of metal. Adjustment of jack screw and 2 gland nuts, simplify positioning of shot cylinder. No additional piping or flexible tubing required.

Write for free detailed bulletin and specifications, fully illustrated.

Midwest MACHINE CO., INC.
Manufacturers of Midwest-Foster Die Casting Machines
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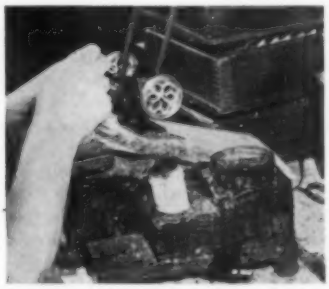
1. STEEL SPINDLE is cast as an insert in the center of the gyroscopic tops.

2. DIE HALVES on outer turntable rotate about center die section, opening one side, closing the other.

PERMANENT MOLD CASTINGS

3. TRIMMING LATHE performs all machining by making three cuts in a single setup.



4. PAINT STRIPING is done two-at-a-time by using a hand held brush.

By JACK G. CHANDLER,
President
Chandler Mfg. Co.

Unique casting and finishing of toy gyros gives

Precision Lead Castings At Low Cost

TOYS must be considered as expendable items, therefore, they must be made at low cost and at high speeds if they are to compete in a mass market. For these reasons, it is usual to use one or more of the precision metal molding methods for the fabrication of metallic parts of toys. Chandler Mfg. Co. uses permanent mold castings in lead so that their gyroscopic tops can be sold at a relatively low retail price.

These gyroscopic tops are, however, a very precise and carefully balanced mechanism—they must be if they are to operate properly.

The tops consist of an 11 percent antimony, 89 percent lead fly-wheel with an integrally cast steel shaft. The gimbal is formed from steel wire, formed and spot welded. It is in the permanent mold casting and subsequent finishing of the lead fly-wheel that the precision manufacturing enters to the greatest extent.

Figure 1 shows one of the finished tops with the screw machined steel axle, a rough casting and a finished casting. The casting operation is shown clearly in Figure 2. Here, a unique die set-up is employed. Two molds are used with one half of each mounted on a turntable and the other half of each arranged on a slide mechanism that is actuated by an eccentric.

With the dies in the position shown, one set of them is closed and the lead has been poured. At the same time a finished casting is ready for removal from the second die. After removing the finished casting, the operator places an axle insert into the die and rotates the turntable 180°. This rotation will close the empty die and open the one that contains the casting. The cycle is now ready to repeat.

All operations are by hand, as can be seen, but with this two-die, semi-automatic operation, some 2,500 castings can be produced per eight hour shift.

Continued on page 69

How Dimensions And Properties Are Affected By

Adding Copper To Iron Powder Compacts

Part Two

BY P. ULF GUMMESON & LENNART FORSS
Hoeganaes Sponge Iron Corp.

Causes of Growth and Shrinkage

To obtain a closer view on the mechanism of copper growth, it is necessary to discuss separately the factors causing *growth* and the factors causing *shrinkage;* the algebraic sum of which is equal to the so-called "copper growth."

Growth: It seems justified to assume that growth factors are equal for all pure iron powders and can be determined from the iron copper constitutional diagram and the lattice structure of the alloy.

When a certain amount of copper is completely dissolved in the iron, it can be expected that the increase in volume of iron is approximately equal to the volume of the dissolved copper plus a growth which originates in the expansion of the iron lattice when copper atoms are substituting iron atoms at temperatures above the alfa-gamma transformation point and remain in the lattice after cooling. There is metallographic evidence that, at the cooling rates encountered in normal sintering practice, little, if any, copper will precipitate.

Taking into consideration that the maximum solubility of copper in iron at the temperatures involved is in the region of 8-9 percent, these idealized growth factors can be estimated to maximum 3-3.5 percent linear expansion. It is obvious that this growth of volume cannot fully be offset by the pores in the compact, or the pores left by the copper particles.

Shrinkage: It, therefore, follows that the explanation for the different copper growth properties among different iron powders most likely is to be found in the factors causing shrinkage during sintering. These consistently present shrinkage factors are superimposed on the growth factors, and therefore are to decide the final dimensions.

Since so many variables influence these shrinkage factors, it seems logical to conclude that process variables should be chosen to give maximum dimensions, if close tolerances are desired, which is in accordance with our experience.

At what stage in the sintering cycle do the growth and shrinkage factors respectively become important? We can expect to find part of the answer in the following tests.

Figures 12, 13 and 14 show in graphic form the result of dilatometric tests on the previously discussed three reduced iron powders, A, B and C, having different copper growth characteristics. Figure 12 shows dimensional changes during sintering with 7½ percent copper.

The behavior of the three powders is very similar up to approximately 900 C. or up to the point of transformation of alpha-iron to gamma-iron, which results in the shrinkage of the specimens between 900 C. and 1000 C.

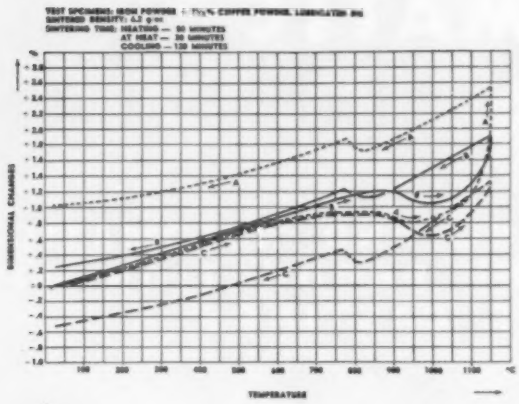
Above 1000 C. all three specimens start to grow more than is explained by thermal expansion. The difference among the three powders is substantial. During the cooling period we notice, in addition to the thermal contraction, the transformation of gamma-iron to alpha-iron at a lower than normal temperature for iron, the explanation for which is to be found in the dissolved copper.

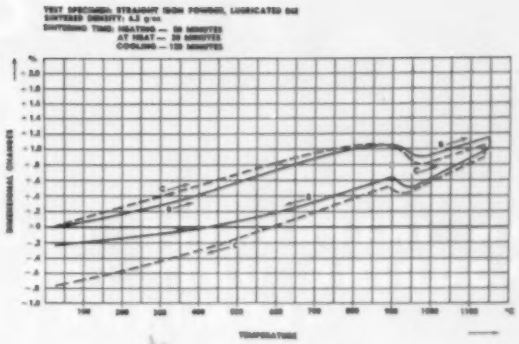
Dimensional changes during sintering *without* copper are illustrated in Figure 13 for B and C iron. By subtracting these curves from the ones in Figure 12, we should be able to picture the *net* result of copper-additions to the powders, by eliminating all changes due to thermal expansion and contraction, escaping gases, transformations, etc., as well as straight iron dimensional changes. The calculated net changes for B and C irons are shown in Figure 14.

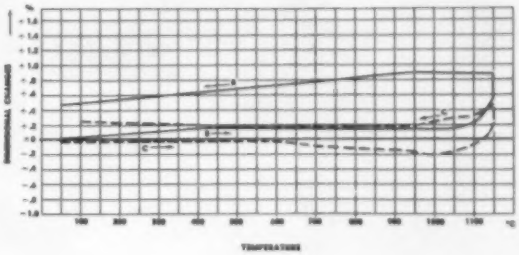
When drawing conclusions from Figures 12-14, it should be kept in mind that the low heating rates, and above all, the very low cooling rates necessary because of limitations in the test equipment, are factors that limit the application of the results.

It seems justified to state, however:

1. That copper growth does not start until at or slightly below the melting point of copper.
2. That the growth continues for some time after the







12. Dimensional changes during sintering of test specimens of iron powder plus 7½% copper.

13. Dimensional changes during sintering of test specimens of pure iron powder.

14. Calculated net changes during sintering of test specimen of iron powder plus 7½% copper.

specimens have reached sintering temperature.

3. That the growth is offset to some extent by a shrinkage, the magnitude of which is depending on some property of the iron powders.

We have previously assumed that the growth should be equal for all pure iron powders and be in the magnitude of approximately 3 percent linear expansion.

To explain the shrinkage, it is necessary to discuss the mechanism of sintering, which subject has been well covered in the literature, [6,7,8,12].

If the net copper content of an iron part is 7-8 percent, the result of sintering under normal conditions must be complete dissolution of the copper into the iron. Diffusion of copper atoms into the iron should result in expansion of the iron skeleton.

However, if the copper phase is liquid, there will be a rapid saturation of this liquid phase with iron, followed by an exchange of atoms between the iron-rich and copper-rich phases resulting in dissolution of iron atoms from areas with high curvature and reprecipitation of an iron rich phase on areas with low curvature. This process is densifying.

It seems justified to believe, that the more irregularly shaped the iron particles are, the finer their pore structure, the greater will the contact area with the liquid phase be and the faster will densification due to atom displacement proceed, offsetting the expansion due to the copper dissolving in the iron.

This process of dissolution and reprecipitation is virtually confined to the interval of the liquid phase existence. The velocity with which the liquid phase is formed, as well as its duration, has a large influence on densification. (See Figures 9-10-15).

This influence of copper on the densification rate is present to a lesser extent also below the melting point of copper, although we here have sintering by solid phase diffusion only. F. V. Lenel and H. S. Cannon[8] studied these phenomena under somewhat different conditions and explained the densification process as composed of liquid flow, solution and reprecipitation and solid phase sintering. W. Dawihl and W. Rix[12] discuss the solid phase sintering as particle transformation and particle adaption, attributing the sintering properties to the production method and preliminary treatment of the powders.

What is said above will apply to our problem and it seems as if one of the main reasons for the different copper growth values of pure iron powders is to be found in differences in their pore structure, specific surface and particle shape.

The finer the pore structure, the larger the specific surface and the more irregular particle shape of the iron powder, the more will the densification rate during sintering be accelerated by the presence of a second phase that is liquid, or at least near its melting point. A number of observations support this statement.

The three iron powders, A, B and C have widely different pore structures. Powder A has the coarsest pore structure and largest copper growth and powder C the finest pore structure and smallest copper growth, while powder B in both respects takes an intermediate position. Powder A has the smoothest and powder C the most irregularly shaped particles. Determinations indicate that the specific surface of Powder B is in the magnitude of 3-5 times that of powder A.

It could be expected that the dissimilarity in densification will appear with other liquid phases

Continued on page 83

The New DUPLEX
AJAXOMATIC

AN INTEGRATED MELTING AND AUTOMATIC POURING UNIT FOR THE PRODUCTION OF ALUMINUM DIE CASTINGS

Here for the first time the functions of continuous melting of aluminum, maintaining the molten metal closely at lowest possible temperatures, and automatic pouring of controlled amounts of metal are combined in one compact unit.

The Duplex AJAXOMATIC is intended for those die casters who prefer to have each die casting machine a completely self-contained unit, starting with pig metal and scrap, and ending with the casting.

This unit represents the ultimate in integration and automation to match today's trend towards larger die castings and higher production rates per machine and per manhour.

For more information circle No. 4 on the Reader Service Card

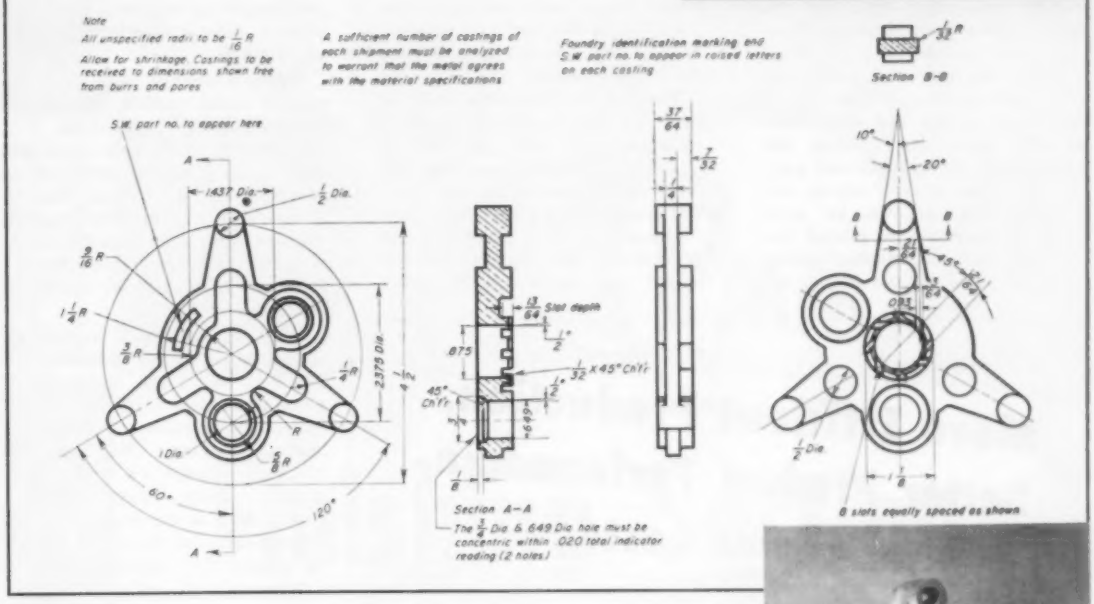
AJAX

TAMA-WYATT

AJAX ENGINEERING CORP., TRENTON 7, N. J.

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax Hultgren Electric Salt Bath Furnace


Note
All unspecified radii to be 1/16 R
Allow for shrinkage. Castings to be received to dimensions shown free from burrs and pores
A sufficient number of castings of each shipment must be analyzed to warrant that the metal agrees with the material specifications
Foundry identification marking and S.W. part no. to appear in raised letters on each casting
Section B-B
S.W. part no. to appear here
1.437 Dia.
1/2 Dia.
2.375 Dia.
4 1/2
1 Dia.
60°
120°
Section A-A
The 1/2 Dia. & .649 Dia. hole must be concentric within .020 total indicator reading (2 holes)
10°
20°
45° Chfr
1/2 Dia.
8 slots equally spaced as shown

Eliminate Milling . . .
The Most Expensive Operation

THE most pressing reason for changing a method of manufacture of a component is to reduce the ultimate cost. That is, the cost of the part when it is ready to be assembled into a machine. Very broadly speaking, when a green sand casting is involved, the change is made to cut down overall machining and to reduce rejects due to poor dimensional stability or rejects due to porosity.

While all machining operations are relatively expensive, when it is possible to reduce or to eliminate milling machine operations it is generally possible to show a major cost reduction. All of these reasons: reduced machining, better dimensional stability and reduced porosity were the cause for a change from a sand casting to a plaster mold casting of the

Continued next page

TABLE 1. Sand cast vs permanent mold* cast properties

Composition:	Minimum	Maximum
Copper	0.25	1.50
Zinc	7.00	9.00
Nickel	—	0.20
Iron	—	1.00
Manganese	0.20	0.60
Silicon	—	0.40
Magnesium	0.20	0.60
Titanium	0.10	0.30
Chromium	—	0.30

Physical Properties: Aged 10-14 days, room temperature.

	Sand Cast	Permanent Mold Cast
Tensile Strength, psi	35,000	40,000
Yield Strength, psi (0.2%)	25,000	27,000
Elongation, % in 2 in.	4-5	6-7
Brinell Hardness	74	74
Charpy impact, ft. lbs.		
notched	3	3
unnotched	14	20

*(The properties of the plaster mold cast parts will lie between the sand cast and permanent mold cast properties, probably somewhat closer to permanent mold than to sand cast.)

burner mounting used by the South Wind Div., Stewart-Warner Corp., shown on page 47.

When the part was sand cast, the most expensive single operation was cutting the eight slots in the collar surrounding the center hole. Both angle and position of these slots is highly important and, as can be seen, some of them are so placed that milling with a standard cutter was not possible, due to the adjacent boss. While it is only necessary to hold the position of the center line of each slot to within ±0.010 and the width to ±0.005, sand casting was not able to meet the requirements.

Most other dimensions could be held by the foundry, provided sufficient stock was left. But the clean-up operation required almost overall machining and when this was done, porosity was often disclosed, causing rejection of the casting. Suct rejects are not only expensive in that the entire cost of machining up to the point of rejection are lost, but if many parts must be rejected there can arise a serious interference with production.

When a change was made to plaster mold casting, almost all of the former machining was eliminated. The center slots are cast to as great an accuracy as is required, the overall dimensional accuracy is good enough so that no surface machining is required and rejects due to porosity have been reduced almost to the vanishing point.

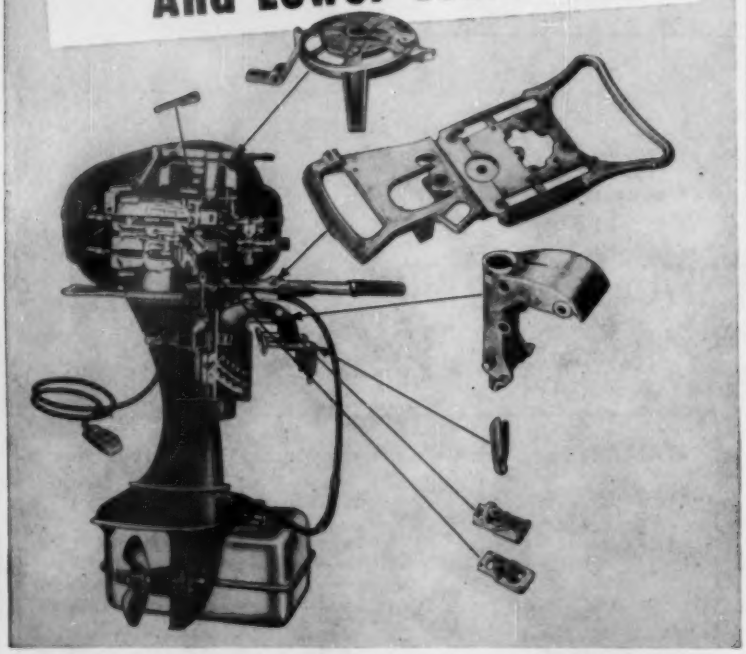
While it is possible to core all of the holes except possibly the one very small one, it was found to be much less costly to drill all except the three larger ones. (See casting drawing.) This was particularly true since a drill jig was available from previous production as well as the drilling set-up. Threaded holes must, of course, be tapped after casting.

With the change in manufacturing method the only machining that has to be done now is drilling and tapping, both very inexpensive operations.

The alloy in which this part is cast is a high strength age hardenable aluminum base material. It has the advantage of aging at room temperature to substantially full strength in about 10 days with practically no distortion during aging.

Another advantage of this particular alloy is that it is castable by almost any method desired. The composition and physical properties of the material are given in Table I.

More Efficient Production, Better Product Performance And Lower Costs...



are reasons why SCOTT-ATWATER uses ACCURATE die castings

■ Because of their uniformity and light weight, ACCURATE die castings greatly reduced the time required for handling and assembly. Cast to close tolerances, they reduced or eliminated machining operations, special tooling and scrap loss. In addition, a more dependable and efficient motor was produced with die castings that have high strength-light weight properties and are non-porous and leakproof. Perhaps you too, can improve your product and profit picture with ACCURATE die castings. Write, wire or phone if you have a parts problem demanding immediate attention.

ALUMINUM • ZINC • MAGNESIUM DIE CASTINGS

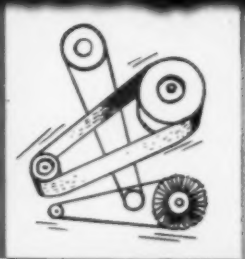
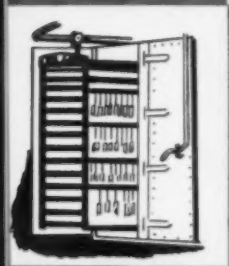
ACCURATE DIE CASTING CO.
3089 E. 80th STREET • CLEVELAND 4, OHIO

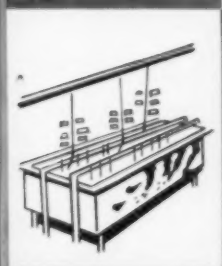
For more information circle No. 2 on the Reader Service Card

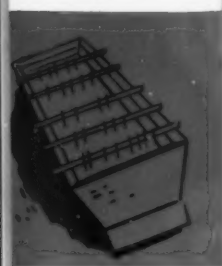
DU-WEL ANNOUNCES EXPANSION PROGRAM

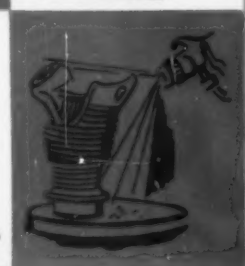
Plans for the construction of a new office section to house its engineering departments have been announced by Du-Wel Metal Products, Inc., Bangor, Mich. jobbing die caster. Approximately 600 square feet of office area are to be added to the present building. Some additional manufacturing space is also to be provided at the rear of the building area.

According to D. J. Walton of Du-Wel, this is the sixth time in the past nine years that the physical facilities of the plant have been enlarged to accommodate increased business.







PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

devoted to the specialized problems of finishing...

DIE CASTINGS • INVESTMENT CASTINGS • PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS • POWDER METAL PARTS • SHELL MOLD CASTINGS

LE ROY MACHINE CO., LE ROY, NEW YORK

COMPARATIVE FINISHING COSTS FOR JET ROTOR COMPRESSOR DISCS

FINISHING METHOD	FINISH TIME	COST PER DISC	QUALITY	DISCS PER YR.	COST PER YR.	PROD. INCR.	COST SAVINGS
FILE AND WIRE BRUSH	18 HRS.	$124.92	VARIED	231	$28,870	—	—
SUPERSHEEN DBF-200 BARREL	4 HRS.	$ 5.68	UNIFORMLY GOOD	1040	$ 5,907	450%	$124,000

HOW AIRCRAFT PARTS FIRM SAVED $124,000 WITH ONE SUPERSHEEN BARREL

This Almco SUPERSHEEN fixture-type barrel is paying for itself every week.

Compressor rotor discs for jet aircraft must be finished to rigid Air Force specifications at the Le Roy Machine Co., a New York manufacturer of automotive and aircraft parts. Above you see the final inspection of these parts, just barrel finished. Inspected under powerful magnifying glass, critical break-edges of the discs are right down to A. F. specs.

"Supersheen methods were largely responsible for achieving and maintaining the high quality required for aircraft manufacture," reports R. O. Braaten, Le Roy project engineer. Prior to the installation, the rotor discs were deburred by file and wire brush.

Then an Almco finishing engineer recommended that some sample discs be barrel finished . . .

In Almco's Newark laboratory, it was found that deburring these parts required tough, Supersheen bonded abrasive chips, ⅛ in. steel diagonals and abrasive compound to meet strict A. F. requirements and yet get the fastest possible cutting, grinding and polishing action.

That's how the SUPERSHEEN METHOD cut finishing time from 18 to 4 hours per disc, achieving absolutely uniform finish. Too, production was increased 450 percent, saving $124,000. annually on deburring costs.

Remember, the SUPERSHEEN METHOD is a complete barrel finishing service that begins with an Almco finishing engineer analyzing your specific problem. Then free tests are conducted on your sample parts at the Almco laboratory nearest your plant. The correct media, compounds, barrel rpm, water level and time cycle are determined in order to precision finish those parts; often a complete test can be run in a matter of hours.

Helping you select the correct size barrel or barrels for your operation is the next step. And whenever you need expert help in finishing problems, ALMCO is at your service. For further information and literature, write, Almco, 104 Marshall St., Albert Lea, Minn.

ALMCO

Division of Queen Stove Works, Inc.,

ALBERT LEA, MINN.

SUPERSHEEN METHOD
FOR
SPEED FINISHING

ALBERT LEA • NEWARK • DETROIT
PHILADELPHIA • NEW HAVEN
LOS ANGELES

For more information circle No. 72 on the Reader Service Card

Color Boosts Adding Machine Sales

EPOXY ENAMELS in a range of colors give a handsome, non-glare finish that meets all functional needs.

ADDING machines in a variety of attractive colors have been introduced this year by Burroughs Corp. of Detroit. In place of the standardized neutral colors that are traditional in the business machine field, Burroughs has taken a leaf from the notebook of today's homemakers, offering its new Ten Key adding machines in a choice of four non-glare pastel colors.

The modern office, Burroughs reasoned, is the environment in which the average worker spends a major share of his hours. Why not introduce the pleasant and harmonious colors with which he is likely to surround himself at home?

Color selection was made by industrial designer George W. Walker on the basis of scientific preference and association testing. By the process of elimination, and considering the major factors of eye strain, fatigue and functionalism, the field of choice was narrowed down from 25 colors to four colors: amber grey, Alpine blue, sea mist green and Capri coral.

Acceptance has been rapid. High production electrostatic paint spray methods are now being used to apply the pastel colored finishes to the die cast aluminum housings for the Ten Key.

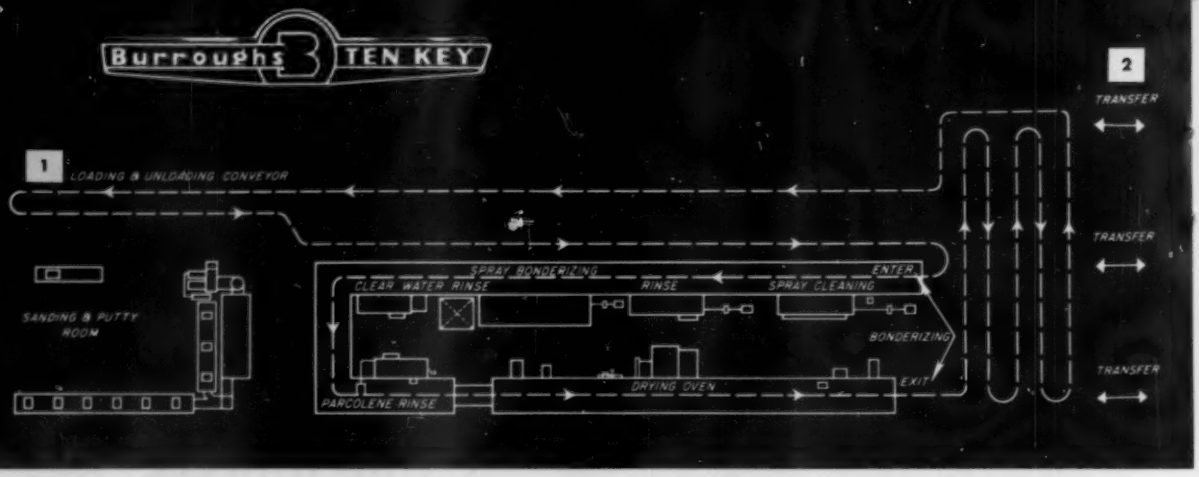
An epoxy type synthetic enamel, with a phosphate pre-treatment is applied to promote paint adhesion and to protect the casting against corrosion. Precision baking methods have been developed in order to develop optimum properties of durability, adhesion and color match in the surface coating.

Burroughs has a completely conveyorized system which occupies the greater part of one floor of its Detroit plant for painting these and other adding machine components.

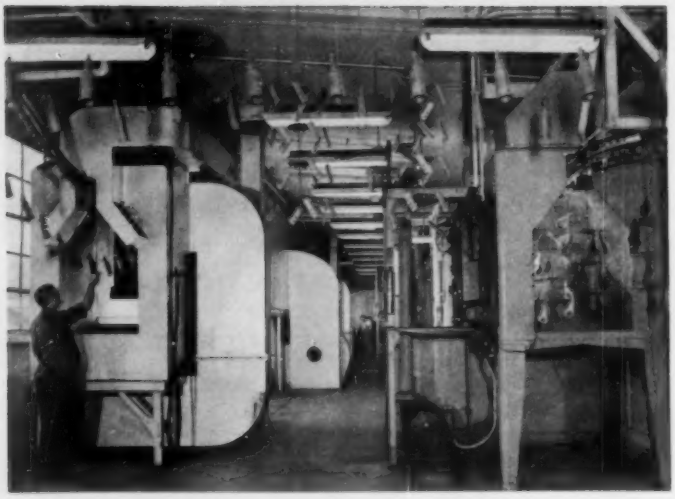
Ten Key die castings go through the following cycle: 1) Rack; 2) Spray Bonderize in five-stage cycle for phosphate coating; 3) Air dry; 4) Transfer to paint line; 5) Electrostatic paint spray; 6) Retouch with hand spray; 7) Bake; 8) Transfer off paint line and move by hand truck to spot putty and sand; 9) Rerack on paint conveyor; 10) Air blast to remove dust; 11) Apply second coat of paint; 12) Oven bake; 13) Move by truck to quality control department for inspection; 14) Move to assembly department for attachment of hardware and sound-deadening felt; 15) Inspect.

On the following pages are the flow chart and photos illustrating the processing of these aluminum die castings from the time they are placed on the conveyor until they are ready for the assembly line.

PHOSPHATE COATING AND ELECTROSTATIC PAINTING AT BURROUGHS



1 RACKING is simply a matter of suspending the die cast housings from hooks on the over-head conveyor system which carries them through the phosphate coating cycle before being manually transferred to another conveyor system for the painting-baking cycle.

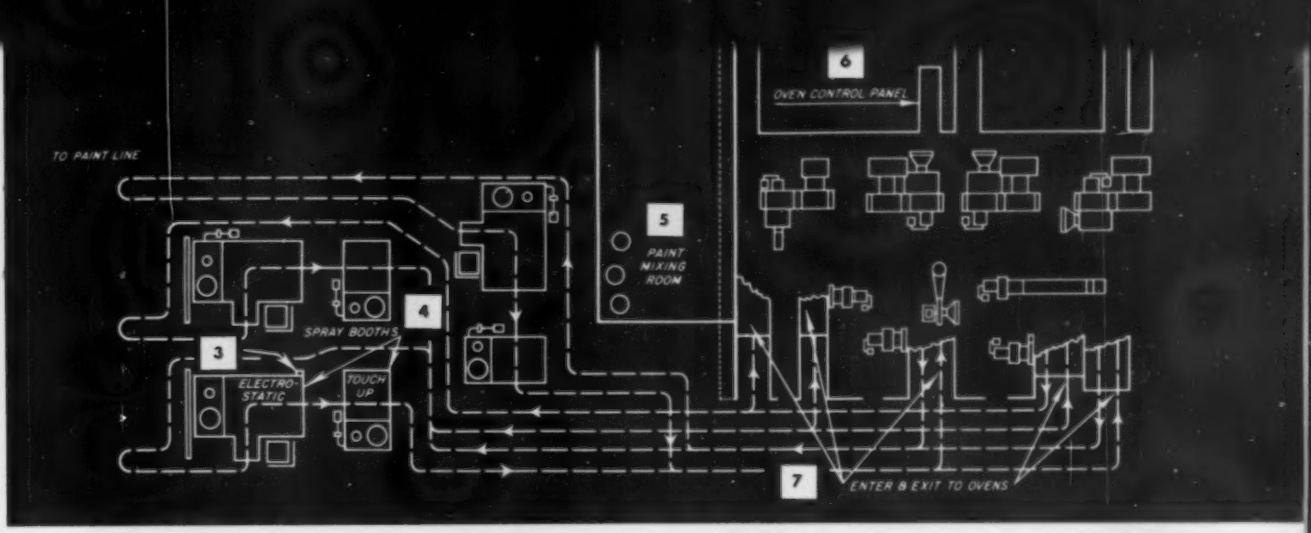


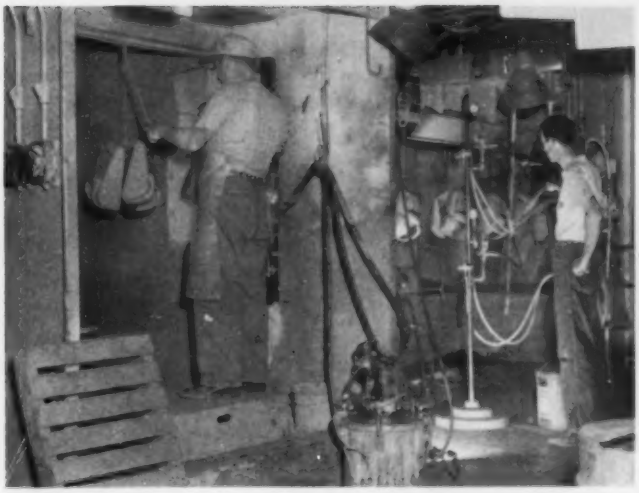
2 PHOSPHATE coating cycle is accomplished with this automatic spray Bonderizing unit which carries the castings through five stages arranged in a U-shaped, completely enclosed system. Zinc and aluminum die castings can be processed along with steel stampings.

a PMM photo story

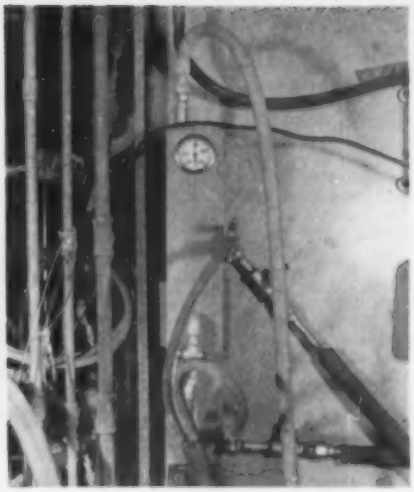
COLOR BOOSTS SALES—Cont.

PAINTING IS A PRECISION JOB. Surface preparation, the first stage, must be planned to provide good base for subsequent coats of paint. Then, with electrostatic paint spraying and accurately heated paint, an exactly controlled paint film is applied. Baking, too, is held to precision limits, with temperatures controlled within five degrees. The result is a quality of finish and a uniformity of color that meets every functional and decorative requirement.



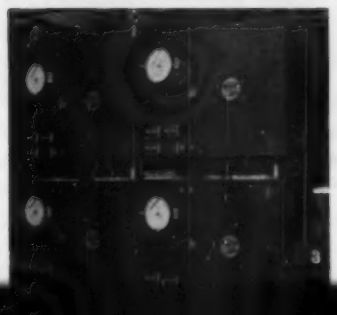


3 PAINTING calls for an electrostatic paint spray booth, ***right,*** followed by manual touch-up, ***left.*** Pinions on the conveyor hook rotate the castings as they pass before the paint spray. Electrostatic spray with heated paint gives high production rates, uniform paint coatings.



4 PAINT IS HEATED with this DeVilbiss hot water heater. Paint at the nozzle is kept at 165 F. Advantages: less solvent is required, paint body is better, greater build-up is achieved. In one spray cycle, heated paint gives a 2 mil deposit, compared with about 1 mil with cold paint.

5 PAINT MIXING must be carefully controlled to obtain proper color match, viscosity and properties. In this mixing room and throughout the paint department, careful temperature control and complete air filtration for dust removal are important features.



6 TEMPERATURE CONTROL in baking is very critical: wrinkle finishes must be held within 10° variation, while epoxy enamels must stay within 5° to obtain uniform color. These Mahon regulators control temperature for baking epoxy enamels at 385 F.

7 UP INTO THE OVEN goes the conveyor line after the castings have had a brief flash-off period to remove volatile materials. These convection type ovens are over-head, saving floor space. After baking, spot puttying and sanding are done, followed by a second paint-bake cycle.

TO ASSEMBLY

THE FINISHING TOUCH

FINISHING OF ALUMINUM AND ZINC BASE DIE CASTINGS

by D. J. Swaninger
Sales Manager—Stevens Compositions

Each year, during the past decade, the use of zinc base and aluminum die castings has been on the ascendancy. Increased uses have been particularly noted in the automotive, aircraft, appliance, plumbing and radio-television industries.

New finishing techniques have played no small part in the rapid up-surge of die castings usage. The fine detail obtainable makes die castings ideal for decorative hardware and trim.

There are many finishing methods for aluminum or zinc base die castings. The choice is dependent upon final use of the individual part or product.

Typical die cast buffing operation on Stevens lathe.

For aluminum there is polishing, buffing, coloring, scratch-brushing, satin finishing, tumbling, etching, anodizing, bright dipping and electroplating.

For zinc polishing, buffing, tumbling and electroplating methods are used.

Which is best for you? Which will give the finish needed to make your product more saleable at the lowest cost to you?

Frederic B. Stevens, Inc., with their years of experience, can recommend the correct finishing procedure and furnish the equipment and supplies needed for the finishing of aluminum or zinc base die castings. Whether it is chemicals,

Stevens Model B Copper, Nickel, Chrome Die Cast Plating Machine.

compositions, lathes, automatic polishing equipment, Roto-Finish equipment or completely automatic electroplating and finishing machines, Stevens has it.

Perhaps we can help you with a Stevens L. V.* report. Write us on your company letterhead describing your product, the finish desired and required production.

*Laboratory Verified.

FREDERIC B.
STEVENS
INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

Circle No. 84 on the Reader Service Card

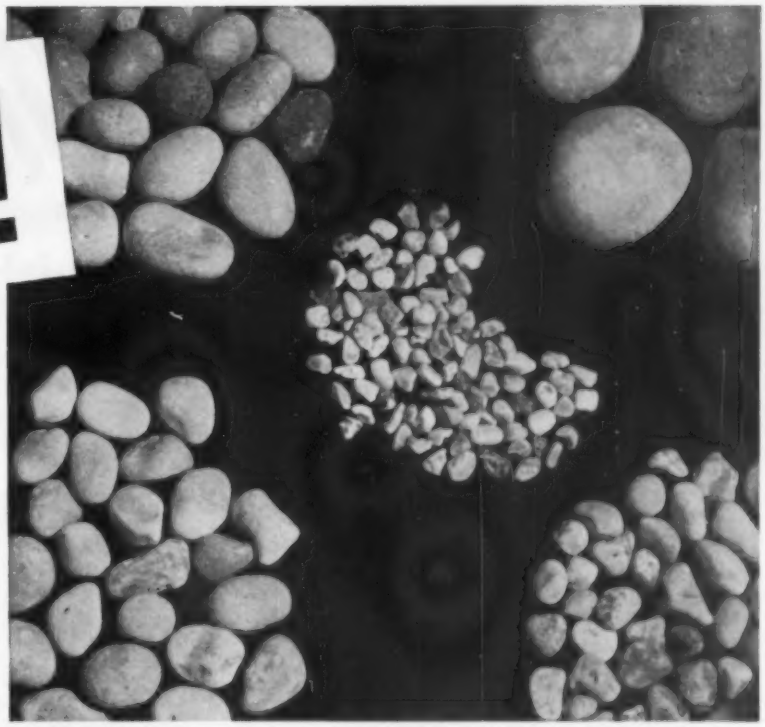
8. NAMEPLATES ARE ATTACHED to the housing by pressing integral bosses formed on the rear surface of the die cast zinc emblem through holes in the housing and slipping Speed Nuts over the bosses.

9. HOPPER-FED ARBOR PRESS is used to insert rubber feet into the holes cored through the base die casting.

10. SOUND-DEADENING FELT is coated with an adhesive material and then attached to the inside surfaces of the die cast housing in this bench operation. Special conveyor carries the coated felt to the operators.

NEW!

TUMBLEX "N" Abrasive



PROCESSED BY NATURE and offered exclusively by Norton, the new Tumblex "N" Abrasive comes in sizes ranging from 3/16" by 3/8" to 1 5/8" by 2 1/2".

A natural for better barrel-finishing

Latest tumbling abrasive — natural flint stone — offers new "TOUCH of GOLD" benefits — brings finish up and costs down

Tumblex "N" Abrasive is Nature's own tumbling abrasive. Carefully selected and graded by Norton, it opens up new possibilities for barrel-finishing applications such as light deburring, breaking sharp edges, polishing and burnishing and other operations where little actual cut is required.

Tumblex "N" has proved particularly valuable in bringing out the most desirable color of the finished part. Metals on which it has proved its ability to give an excellent finish include zinc, brass, copper, aluminum and various forms of steel, including stainless.

Its rounded, uniform shape and very low breakdown ratio prevent wedging, permit longer cycles and reduce the need of rescreening.

Another big Tumblex "N" advantage is extremely uniform cutting action. This assures the same uniform finishing in load after load. Also, it enables close regulation of cut; for example, by adding measured quantities of loose abrasive grain to Tumblex "N" you can speed up the rate of cut with little effect on the life of this natural abrasive. Exact formulas for best results in job or production tumbling are easily worked out.

Norton customers who have tested Tumblex "N" Abrasive report:

- *"Very good luster with no noticeable wear."*
- *"Fine performance. Very little breakdown. Reordering 700 pounds of sizes 2½T and 3½T."*
- *"Color O.K. on both zinc and brass."*
- *"Very long life. Gave excellent color on stainless steel."*
- *"A good polishing stone on aluminum."*

Send Your Work Samples

Let us demonstrate in our newly enlarged Sample Processing Department how Tumblex "N" Abrasive can give the value-adding "Touch of Gold" to your product quality and cut your barrel-finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. G-297

NORTON

ABRASIVES

Making better products... to make your products better

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Abrasives • Grinding Wheels
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BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones
Pressure-Sensitive Tapes

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25% FASTER TUMBLING

with

TUMBLE
GRAV-I-FLO
FINISH

Equipment and materials combined to increase direct-labor savings over other tumbling methods!

25% More Volume in
30% Less Floor Space!

MODEL 48"
Two Compartments

than comparable machines.

Grav-i-Flo's larger capacity plus improved cutting and finishing materials slash processing time—no need for transferring parts from cylinder between roughing and finishing. Get speed *and* smoother surface, higher lustre by asking for a Grav-i-Flo representative to visit your plant, or by sending us samples.

SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

Grav-i-Flo Corp., Dept. PMM-11, Sturgis, Mich.
☐ Send complete catalog. ☐ Have Sales Engineer Call.
☐ We are sending samples.

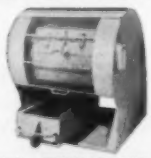
Company _____
Name _____ Position _____
City _____ State _____

GRAV-I-FLO CORPORATION, 400 Norwood Avenue, Sturgis, Michigan

COMPLETE EQUIPMENT, ACCESSORIES AND SUPPLIES

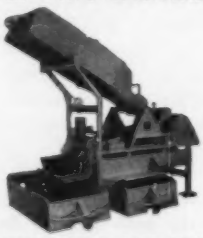
MODEL 66"—TWO COMPARTMENTS

MODEL 36"—TWO COMPARTMENTS



MODEL 32"—TWO COMPARTMENTS

MODEL 24"—TWO COMPARTMENTS



CHIP SEPARATOR AND GRADER

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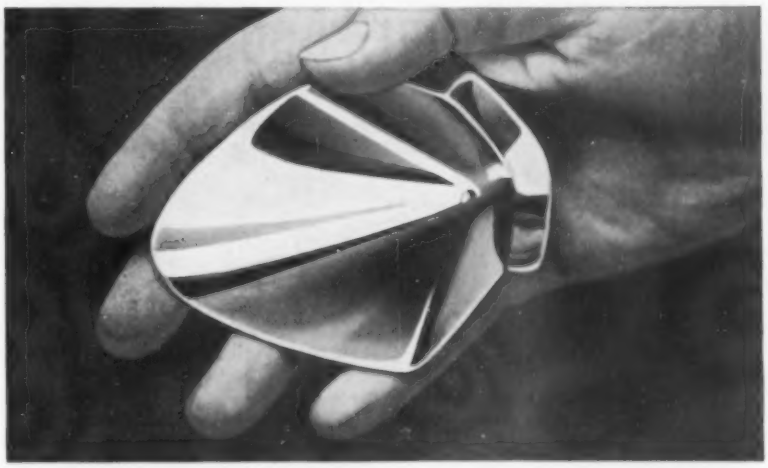
UNICHROME
Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Copper Plating Fit for Die Castings

Non-cyanide Unichrome Copper delivers operating features of special interest to die casters



Ready for direct bright nickel plating, this die casting shows the typically lustrous copper plate from Unichrome Copper. Courtesy Royal Plating and Polishing Co., Inc., Newark, N. J.

There are definite differences to be seen in both the deposits and the operation of different copper plating solutions.

In the case of the Unichrome Pyrophosphate Copper Process, the differences are of direct benefit to plants plating die castings.

SMOOTHNESS IS BASIC

Unichrome Copper deposits are noted for their essential smoothness and uniformity when plated over a wide current density range.

Since the solution also is nearly neutral in pH, it is well suited for plating light metal castings. Of the alkaline copper solutions, Unichrome Copper has an advantage in its relative insensitivity to metals, organics, etc.

NO BUFFING

With newly perfected addition agents, a lustrous deposit is produced which proves ideal for direct plating with nickel. It needs neither buffing nor activation treatment.

The addition agents not only give even wider bright plate range than obtained with the basic bath, but also step up plating speed as much as 20%.

EXTRA BONUS

Disposal of cyanide wastes is a problem that can't be overlooked. But it can be minimized with non-cyanide Unichrome Pyrophosphate Copper. As one user recently put it, "a pyrophosphate-type copper solution was selected because of its wide brightness range and because it does not present a serious waste disposal problem."

MATCHED PLATING PROCESSES

Unichrome Copper is also part of a matched set of processes for better copper-nickel-chromium finishing. Its deposit is ideally receptive for Unichrome Bright Nickel, which in turn, is unusually receptive for chromium deposits and which works outstandingly well with Unichrome SRHS Chromium.

Send for details on all three processes.

United Chromium now provides plating equipment

Much time and money can today be saved in designing new plating facilities and in buying new equipment. United Chromium now plans and supplies equipment for general plating, offering the benefit of over 25 years close working experience with plating plants.

Already several complete installations have been made by United Chromium, and have included plating and cleaning tanks, rectifiers, heaters, blowers, anodes and the like. By working with United Chromium, these plants assured equipment designed for efficiency and economy.

EXAMPLE OF ECONOMY

Unichrome Tantalum Heating and Cooling Coils are not just acid-resistant but actually acidproof to all common plating acids except hydrofluoric. Outlasting lead by far, they often more than pay for themselves by minimizing downtime and maintenance.

EXAMPLE OF EFFICIENCY

Unichrome Round Anodes, an original United Chromium development, are active over their entire surfaces and distribute the current better. When they replaced "flats" in an automotive plant plating tank, they eliminated former need for costly weekly maintenance. They also plated better with less power, enabling a $29,000 standby generator to be switched to other work.

United Chromium will be glad to consult with you on your equipment requirements.

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For more information circle No. 85 on the Reader Service Card

This Process Gives Color Plus Protection, But . . . . .
CAN ALUMINUM DIE CASTINGS BE COLOR ANODIZED?

So far, the use of color anodized coatings on aluminum die castings has been very limited. The problem . . . the high silicon alloys which are commonly used because of their excellent castability, give a smutty, streaked appearance. They can only be dyed in dark colors. Alloys that can be color anodized successfully are too difficult to cast because they tend to solder to the die casting die.

However, the chief engineer of a prominent custom die casting firm has expressed great optimism with regard to the development of a die castable aluminum alloy that can be satisfactorily color anodized in bright, light colors. Work is progressing in this direction at the present time.

More widespread use of color anodized aluminum die castings seems imminent and, when the technical problems are overcome, this should have an important influence on the number of aluminum die castings used on automobiles, household appliances and other places where color, durability and cost are important.

How To Color Anodize Aluminum

By F. P. STILLER
Sandoz Chemical Works, Inc.

COLORED anodized aluminum has recently become the subject of a great deal of attention throughout the metal-processing industry. Much of this interest can be attributed to the theme of modern living: new colors and their widespread use in interior decorating, kitchen appliances, automobiles, jewelry, etc.

The characteristics of dyed anodized aluminum are ideal for its use in this manner. Brilliant color, resistance to scratching and chipping, and ease and economy of application are but a few of the reasons for its increasing popularity.

What Is Color Anodizing?

The anodizing process is not new. As early as 1924 patents were issued for the electrolytic oxidation of aluminum in a chromic acid bath to G. D. Bengough, and J. M. Stuart, British Patent 223,994. The first patent on anodizing with a sulfuric acid electrolyte was issued in about 1930 to Aluminum Colors, Inc., Indianapolis and since that time additional patents covering sulfuric acid concentrations over a wide range have been granted. These patents have since expired.

Methods of anodizing, utilizing oxalic, sulfamic, boric, sulfonic, and other acids as electrolytes, plus modifications of the sulfuric acid process by the addition of metallic salts have been developed during the intervening period. However, the 15-20% sulfuric acid bath remains as the most widely used electrolyte.

In 1925 F. B. Flick (U.S. Pat. 1,526,127) discovered the ability of the aluminum oxide film to be colored by numerous organic dyestuffs. Since that time Sandoz Chemical Works has pioneered in the development and application of specific dyes for the metal finishing industry.

The mechanics of forming the artificial oxide coating are simple. The aluminum is immersed as the anode in a suitable electrolyte solution and an electric current supplied. As the current flows through the electrolyte, hydrogen is liberated at the cathode (usually lead) and oxygen is liberated at the anode where it combines with the aluminum to form Al_2O_3.

Since the oxide is a non-conductor, if it were not for the solvent action of the electrolyte, this action would cease once a continuous film was formed. The electrolyte, however, partially dissolves this oxide film creating a series of pores in the coating which allows continued passage of the electric current. These pores, of microscopic size, give this film its ability to absorb dyes by capillary action.

When the oxide film thus formed is subjected to moisture and heat some of the Al_2O_3 combines with water to form Al_2O_3-H_2O, the volume of which is greater than that of the original aluminum oxide. In this manner the anodic coating can be sealed to prevent further absorption of dye or subsequent staining and to increase its abrasion and corrosion resistance.

In actual color anodizing practice, metallic salts (nickel and/or cobalt acetate) are added to the sealing bath to prevent discharge of the dyes and to increase their light fastness properties.

Pretreatment

A flow chart of a typical color anodizing plant is shown at the right. The metal must be chemically clean as for any metal finishing operation. This is accomplished by immersion in an alkaline cleaner inhibited with various agents to prevent chemical attack on the aluminum. Since the inhibiting agents usually form an inert protective film, which

would interfere with subsequent anodizing and dyeing operations, a nitric acid dip is required if the material is not to undergo further chemical treatment before anodizing.

Most material used for decorative purposes is given either a brightening treatment, which may be chemical or electrochemical, or an etch, either alkaline or acid. These treatments should also be followed by a nitric acid dip for smut removal purposes.

Anodizing

The standard anodizing electrolyte consists of 15 to 20% sulfuric acid and is operated in the temperature range of between 70 and 75 F. The time of treatment and current density control the thickness of the aluminum oxide film being developed and consequently affect the depth of color resulting after dyeing. Since the work load usually varies from batch to batch, in commercial practice current density is controlled by applying a specific voltage to the material being processed.

The electrolyte temperature and concentration affect both the thickness and porosity of the coating since they influence both the conductivity of the solution and the rate of dissolution of the aluminum oxide.

For runs of any given color the above factors must be rigidly controlled if reproducible results are to be obtained.

Rinsing And Neutralizing

A complete rinsing of the coating between anodizing and dyeing is of prime importance. The removal of all traces of sulfuric acid must be accomplished for two reasons:

First, certain of the dyes having other desirable properties for aluminum dyeing, are limited in their dyeing ability by the presence of the sulfate ion in the pores of the coating.

Secondly, the introduction of sulfuric acid into the dyebath will result in raising the acidity (lowering the pH) of this bath with a consequent change in the final color of the finished material. The affect of the introduction of acid into the dyebath varies, of course, with the individual dye.

In the case of extremely porous material, such as castings, or

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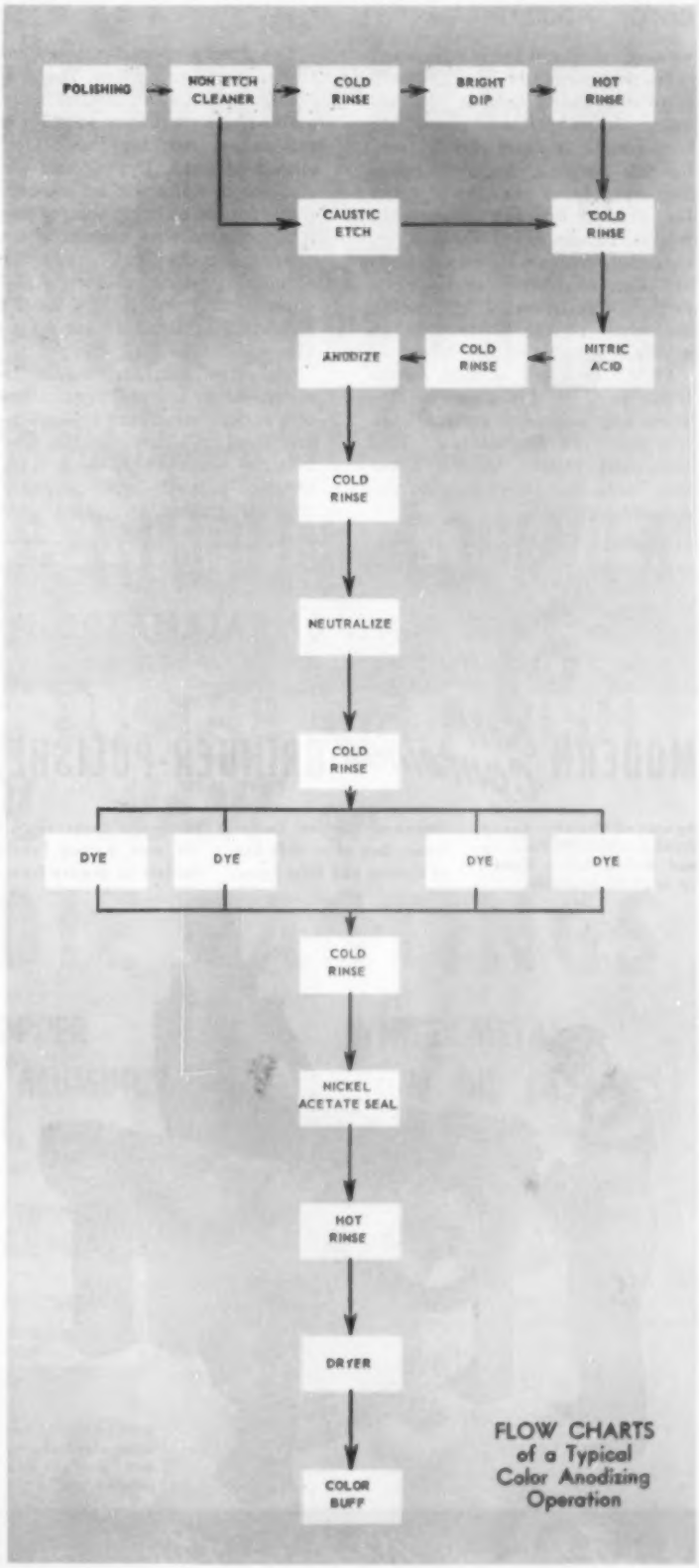

FLOW CHARTS of a Typical Color Anodizing Operation

wrought material having recessed areas that cannot be freely rinsed, a neutralizing bath is of great value. A 5% solution of sodium bicarbonate is most widely used for this purpose, the work being immersed for 5 minutes at room temperature and then thoroughly rinsed. Dilute soda ash (sodium carbonate), or ammonia solutions are also sometimes used, however, there is danger in dissolving some of the coating in an alkaline solution of this type.

Oxalic or nitric acid is sometimes used at this stage to dissolve any occluded matter from the pores of the coating. This treatment results in the oxide film being more receptive to the dye solution.

Dyeing

The dyeing operation is a relatively simple procedure. The previously anodized aluminum is immersed in an aqueous solution of the proper dye for the correct period of time. During this period the dye is absorbed, by capillary action, coloring the coating. It is believed that certain of the dyes react chemically with the aluminum oxide to form color lakes, while others are merely physically retained by the porous film.

The dye solution should be contained in a vessel constructed of a nickel-chromium type stainless steel or a non-metallic inert material such as stoneware, fiberglas, polyethylene, polyvinyl chloride, rubber, etc. Steel tanks lined with any of these materials are entirely satisfactory. If a stainless steel tank is used, the work rack must be completely isolated from the tank both above and below the solution to prevent forming a galvanic cell between the stainless steel and the aluminum. Failure to do this results in precipitation of the dye solution and may even cause corrosion of the aluminum while in the dyebath.

The dyeing time, temperature, concentration, and pH all play an important part in determining the resultant shade and these values must be kept constant. The normal dyeing takes place for 10 minutes at 150 F. Dyeing for a longer period (30 minutes) gives colors of increased resistance to fading although this practice cannot be followed in producing pastel shades such as gold, brass and copper.

The normal dyebath concentration is two grams of dye per liter, except in the case of black which requires from 6 to 10 grams of dye per liter of solution. Here again increased resistance to fading can be achieved by dyeing with stronger dye solutions, but this can only be done when producing heavy shades.

In regard to pH of the dye solutions, most aluminum colors dye well in the range of pH 6.0 to pH 7.0; however, there are exceptions requiring either higher or lower pH values. Initial pH adjustments should be made by the addition of acetic acid, sodium acetate, or sodium hydroxide depending upon the necessary direction of change.

In determining the necessary tank additions, a one-liter sample of dye solution may be titrated with a weak standard solution of the proper acid or base and the exact addition to the tank calculated from the amount required to bring the sample to its predetermined pH value. In order to stabilize the dyebath against pH changes caused by acid carry-over, it may be buffered by adding one gram per liter of sodium acetate plus sufficient acetic acid to bring the pH to the desired value.

Sealing

Dyed anodized aluminum must be sealed in the nickel acetate or

Continued on page 65

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PRODUCT NEWS AND DEVELOPMENTS

POLISHING WHEEL MAY CUT COSTS BY ONE-FIFTH

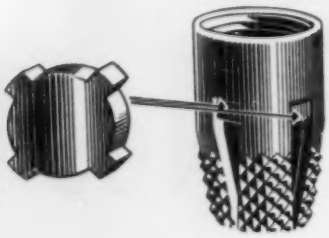
A new device for polishing metal called the PG wheel (polishing and grinding) has been introduced that promises major cost savings for polishing all types of metal plating, painting, or architectural finishing without the use of fine grit set-up wheels, rag or sisal buffs, or brushes.

The new wheel consists of hundreds of pieces of cloth coated-abrasives, factory-formed into a wheel that can be used on rotary or straight line automatics, or on standard lathes for hand operations. It is described as "the most significant development in polishing methods since the end of World War II."

The wheel differs from any other product currently available, in that it removes stock as a part of its polishing action. This abrading-polishing action and the wheel's ability to conform, enable it to remove mild draw marks in the same process in which it generates a buff-type finish.

Minnesota Mining & Mfg. Co.
For more information, circle No. 206 on the Reader Service Card

SELF LOCKING INSERT DESIGNED FOR DIE CASTINGS AND SOFT MATERIALS



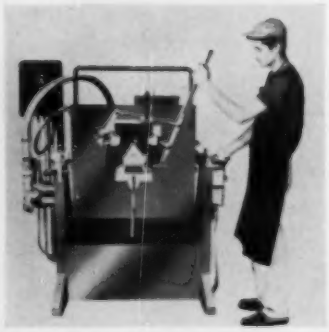
A new type, self-locking brass insert, which eliminates open press time, reduces rejects and speeds assembly, has been developed for manufacturers and users of die castings and all soft materials.

The expansion insert is designed to be placed by hand or to be machine fed into molded or drilled holes at any time after molding. It has effected savings of as much as 20 percent by eliminating open press time.

The insert is a self-contained unit consisting of a knurled brass shield and a locked-in spreader. The insert has a full thread to within 1/32 inch of the depth of the insert. The spreader is driven downward, expanding the insert without contact with the threads. It can be fully expanded in less time than it takes to tap a brass insert, thus speeding assembly.

The Phelps Mfg. Co.
For more information, circle No. 205 on the Reader Service Card

AUTOMATIC CASTING MACHINE FOR PERMANENT MOLD CASTINGS



A new unit is being offered that is said to make the gravity casting in permanent molds almost completely automatic.

Called the Grav-O-Matic this automatic gravity casting machine produces superior quality permanent mold castings at appreciable unit cost saving. The unit eliminates most of the factors in casting that are generally attributed to the human element. Some of these new automatic elements are: metal temperature, pouring control and casting cycle. Casting with this machine can be done by entirely unskilled persons according to the manufacturer.

Other advantages claimed for the casting unit are an increase in production rates of from 20 to 30 percent over other methods of casting. The floor space required is less than 100 sq. ft.

Casting produced by the Grav-O-Matic are said to be superior to conventionally cast parts in that they have a higher tensile strength plus a grain structure equivalent to a forging. The closer dimensional tolerances obtainable reduce machining costs appreciably.

A unique feature offered by the manufacturer of the unit is a leasing arrangement so that there need not be any capital investment in equipment.

Automation-Engineering Corp.
For more information, circle No. 207 on the Reader Service Card

MATCH PLATE METAL
. . . now used for castings

An aluminum alloy that was developed especially for use in making metal match plates is now being used by many die casters and foundries for castings where special characteristics of this alloy are needed.

The aluminum alloy, Salloy, is particularly good where an extremely bright surface is required. The castings are very close grained.

While the initial cost of the alloy is higher than other aluminum casting alloys, the results obtained and the reduction of rejects actually means less final cost in the finished casting.

The alloy is not recommended for general casting purposes because of its higher cost, but where its particular advantages can be exploited, it can be used.

The George Sall Metals Co., Inc.
For more information, circle No. 208 on the Reader Service Card

BARREL FINISHING MEDIA
. . . for heavy cutting or fine finish

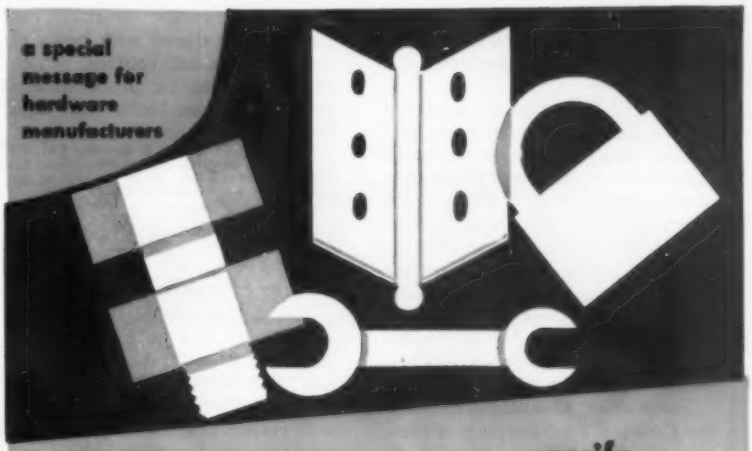
A complete line of abrasive, burnishing, cleaning and neutralizing compounds prepared especially for precision barrel finishing operations has been announced. Four classes of com-

pounds have been formulated specifically to meet varying requirements along progressive stages of barrel finishing operations. They are said not to paste or plug tapped or blind holes.

Class A compounds for heavy deburring and cutting are used for initial stages of finishing. Class B compounds for regular deburring and semi burnishing can be used for follow-up finishing. Class C compounds are for burnishing and Class D compounds for cleaning and buffing action and contribute to finer metal color and finish.

Newton Industries
For more information, circle No. 209 on the Reader Service Card

Continued on page 64



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AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

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WEST COAST LICENSEE: L. H. Butcher Co.

For more information circle No. 71 on the Reader Service Card

LIQUID BRIGHTENING AGENT
. . . for cyanide cadmium plating

A liquid brightening agent for barrel and still tank cadmium plating that is a pure chemical compound of known composition is now available. According to the manufacturers, this new brightening agent eliminates breakdown products and organic impurities.

The brightener called Cadmax is low foaming and will produce clear, brilliant, blue white deposits over an extremely wide range of plating conditions.

Some other advantages claimed for Cadmax are: burning is prevented even with low cadmium metal content in the bath; it permits the use of high throwing power baths without restricting the plating range; optimum results are produced with baths of very low nickel content, which eliminates staining problems encountered when baths with high nickel content are employed.

American Smelting & Refining Co. Federated Metals Div.
For more information, circle No. 212 on the Reader Service Card

IMPROVED PACKING MATERIAL
. . . for hydraulic fluids

A new synthetic compound which may find its principal use in the hydraulic packings field has been developed.

Called Vyram, this material will permit the use of petroleum and fire-resistant fluids. As a replacement packing it will equip present systems for easy conversion from one fluid to another.

The new product, an acrylate-type elastomer, can be fabricated into standard packings and gaskets using conventional processing equipment.

Monsanto Chemical Co.
For more information, circle No. 210 on the Reader Service Card

TOOL AND SNAGGING GRINDER
. . . has built in dust-collector

A redesigned tool and snagging grinder with an improved dust collecting system has recently been introduced.

The major advantage of the redesigned grinder is that the dust collector can be serviced from the front of the machine so that it can be positioned against a wall when that is desirable.

The grinder, available in 1, 2 and 3 HP sizes, is essentially the same unit as the OK grinder previously offered. In fact, the new dust collector can be easily added to the older unit if that is desirable. Addition of the dust collector does not materially increase the floor space requirements.

Hammond Machinery Builders
For more information, circle No. 214 on the Reader Service Card

WET BLAST UNIT
. . . finishes jet blades

A new, automatic pressure blast wet blast unit for finishing jet engine compressor blades has been announced. The unit finishes both sides of the airfoil section at the rate of approximately 200 per hour removing heat treat scale and discoloration without stock removal or distortion. The unit also incorporates a rinse facility for the removal of abrasive compound after blasting.

The blades are manually loaded on simple work holding fixtures which grasp at the root. A conveyor indexes the blades into the blasting chamber where a series of moving guns actuated by an air hydraulic cylinder accomplish the finishing operation.

Continued on page 70

The ABBOTT METHOD
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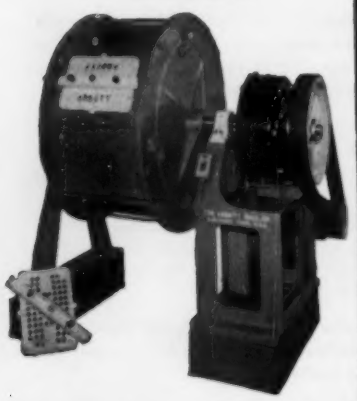

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COLOR ANODIZING
continued from page 60

nickel acetate-cobalt acetate sealing bath. Work sealed in hot water alone is usually unsatisfactory due to bleeding of the dye. The nickel acetate, in addition to preventing loss of dye upon sealing, increases the resistance of the dye to fading.

In the case of certain dyes, there is a chemical reaction between the dyestuff and the heavy metal as is evidenced by the color change that takes place. In other cases the effect of the nickel salt is only physical but nevertheless the treatment is necessary for permanence of color.

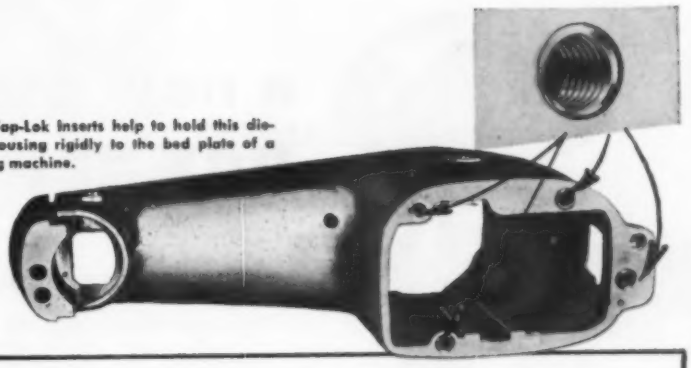
The most widely used sealing formula is 5 grams per liter each of nickel acetate and boric acid. Excellent results are also obtained from a 5 gram/liter solution of nickel acetate in which the pH has been lowered to 5.3 by addition of acetic acid. The treatment should be a minimum of 5 minutes at 195 F with the heavier coatings requiring longer time for complete sealing. In order to insure complete sealing, a treatment in boiling water sometimes follows the regular nickel acetate sealing treatment.

Heavily anodized work usually develops a hazy deposit during the sealing operation. This condition is partly due to the deposit of nickel hydroxide on the surface of the metal and, when the dyeing has taken place in a concentrated dye solution, such as is required for black, residue from the dyeing operation is forced out of the pores as they close in the sealing bath.

Mechanical methods such as buffing, brushing or tumbling with sawdust are most effective in removing this deposit. Since this condition is aggravated by extremely high sealing temperatures approaching the boil, the bath should be held at exactly 195 F. Care must be taken not to reduce the sealing temperature below 190 F as incomplete sealing may occur.

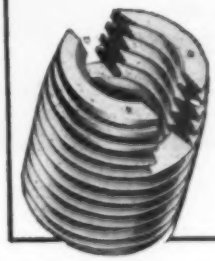
Filtration of the sealing bath, plus addition of certain wetting agents help to minimize the deposit; however, mechanical buffing may still be required for the best decorative finish.

Four Tap-Lok inserts help to hold this die-cast housing rigidly to the bed plate of a sewing machine.



TAP-LOK* INSERTS

make strong points of the weak spots in your assemblies



Tapped threads in non-ferrous materials are often trouble spots unless protected by some sort of hard bushing. Among the latter the TAP-LOK INSERT has all the good points of other bushings, plus the additional feature of being self-tapping. This, of course eliminates a separate tapping operation and reduces installation costs substantially.

Installation is fast and simple, no fussy hole preparation is necessary, thread crossing is impossible, no secondary operations are required, and installation for production or for maintenance can easily be handled by unskilled operators.

TAP-LOK INSERTS withstand vibration without loosening and have maximum torque-and-pull resistance. One simple driving tool, operated through a standard tapping attachment in a drill press or by hand, is all that is required.

*Reg. U. S. Pat. Off.

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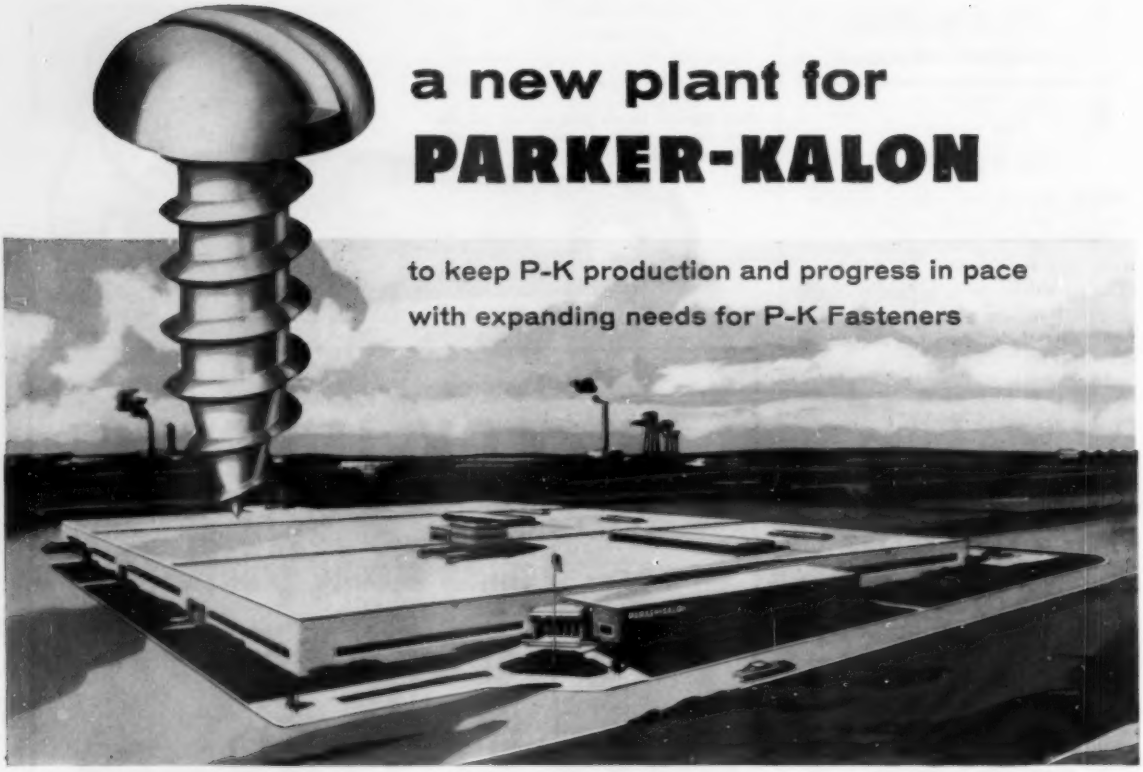
a new plant for PARKER-KALON



In a few weeks, Parker-Kalon will move to its new plant in Clifton, New Jersey (about 10 miles from New York City). This modern building, containing 267,000 square feet on one floor, is one of the largest plants devoted exclusively to the manufacture of fasteners.

It is planned for the highest efficiency and economy in all operations, with production keyed to the steadily increasing demand for P-K Fasteners throughout industry. Advanced facilities for engineering and research will accelerate P-K progress in development of new and improved fasteners.

Now, more than ever, you can be sure . . . "If it's P-K . . . it's OK!"

PARKER-KALON DIVISION
General American Transportation Corporation
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USEFUL LITERATURE CATALOGS, MANUALS

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PROCESSES

Investment Casting: 154

A new booklet dealing with the investment casting process has been issued by the Austenal Laboratories, Inc. Numerous examples of cast parts are given as well as a table giving the chemistry, physical and mechanical properties of investment cast alloys.

Powdered Metal Parts: 155

A four page brochure on the powdered metal process for fabricating parts has been issued by Merriman Bros., Inc. Many of the standard as well as unusual parts that can be made are shown.

Die Castings: 156

In a four page brochure, the Wheaton Die Casting Corp. describes its facilities available for the production of quality die castings in both zinc and aluminum.

MATERIALS AND EQUIPMENT

Pots, Goosenecks, etc.: 157

ACF Industries, Inc. has prepared a brochure describing the melting pots, goosenecks, ingot molds and other industrial castings that can be supplied. Included is a listing of available melting pots by both size and type.

Steel Belt Conveyors: 158

Bulletins No. MF-2-413 and MF-530 have been issued by the May-Fran Engineering, Inc. describing the hinged steel conveyors made by that company.

Increased Crucible Life: 159

A series of brochures is being issued by the Crucible Manufacturers' Association on "Getting the Most from Crucible Melting." No. 5 of this series on burner design and furnace combustion is now ready for distribution.

"Tips" for Pyrometer Users: 160

An 11 page loose leaf service manual has been issued by the Wheelco Instruments Div. of Barber-Colman Co. that gives much helpful information on servicing pyrometers and what to do in case of instrument or thermocouple troubles.

New Stainless Steel: 161

A new ten page technical report on a new stainless steel, a chromium, nickel, molybdenum composition, has been issued by Allegheny Ludlum Steel Corp.

Hose Data Book: 162

The use and application data on Universal Flexible Metal Hose products is offered in a compact reference manual by Universal Metal Hose Co.

Magnesium Topics: 163

The Dow Chemical Co. publishes an external house organ "Magnesium Topics" that details some of the new and unusual uses of magnesium metal.

Pneumatic Temperature Controls: 164

Two models of pneumatic temperature controls for operating diaphragm valves or motors are described in Bulletin 151 from the Burling Instrument Co.

Refractory Metals: 165

An external house organ "Fansteel Metallurgy" which is devoted to applications of tungsten, molybdenum, tantalum and columbium is published by Fansteel Metallurgical Corp.

Titanium: 166

Progress Report No. 2 on the production, properties, applications and fabrication of titanium is now available from E. I. du Pont de Nemours & Co., Inc.

Temperature Measurement: 167

The history of temperature measurement and some notes on modern methods with Tempil products are interestingly told in a seven page booklet that has been published by the Tempil Corp.

High Vacuum: 168

"The Story of the Ring-Jet Pump," a new eight page booklet has just been issued by F. J. Stokes Machine Co.

Combustion & Heat Transfer: 169

A new brochure, bulletin No. 108, that contains detailed diagrams and drawings, together with photographs of Thermal equipment has been issued by Thermal Research & Engineering Corp.

Aluminum Alloy Guide: 170

An aluminum alloy guide, in the form of a slide rule, has been prepared by the Howard Foundry Co. Specification number, composition, properties, etc. are all given for some 61 different alloys, or tempers, for sand and permanent mold castings.

Tool Pre-Treatment: 171

The first in a series of technical fact sheets has just been published by Acheson Colloids Co. This first sheet discusses the pretreatment of dies, piercers and tools used in the metal forming operations.

Fire Resistant Fluids: 172

An all new 19 page book on fire resistant hydraulic fluids has been prepared by Monsanto Chemical Co. All of the technical information needed to determine the applicability of Pydraul F-9 is given.

Literature Index: 173

The Minneapolis-Honeywell Regulator Co., Industrial Div., has published an index of available literature. The index is broken down by Subject, Industry and Product. Catalogs, bulletins, specification sheets, data sheets and article reprints are included.

FINISHING

Drilling and Tapping Head: 177

A new catalog listing the complete line of multiple spindle drilling, tapping, counterboring and chamfering heads has been issued by Errington Mechanical Laboratory, Inc.

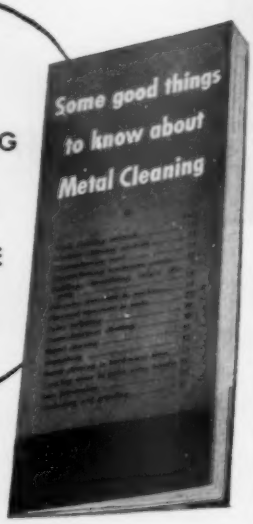
Cross Slide Rotary Table: 178

A new cross slide, rotary table for use on milling, drilling, profiling and other machine tools is described and illustrated in a new brochure from Morrison Engineering Co.

Deburring & Chamfering Tools: 179

The Cogsdill Tool Products, Inc. has just published a 12 page catalog on the line of deburring and chamfering tools made by that company. In addition to the types of tools, the catalog shows a number of typical operations with suggestions of how to do the job.

WHICH METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?



Listed below are some of the operations discussed in Oakite's 44-page handsomely illustrated booklet on Metal Cleaning. Please check the list. Then let us show you how Oakite methods can give you better production with greater economy.

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- ☐ Rust prevention
- ☐ ALSO send me a FREE copy of your booklet *"Some good things to know about Metal Cleaning"*.

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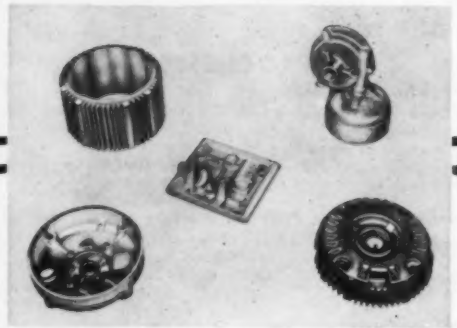
*Company*_____

*Address*_____

For more information circle No. 78 on the Reader Service Card

A Designer's Dreams Can Be Materialized with Die Castings of Aluminum and Magnesium Alloys



For Example: In the Electrical Equipment Industry (and no stranger to every form of industry) is the die cast part made from the new lightweight magnesium and aluminum alloys. Every year has witnessed wider and wider acceptance of these tough and strong metals. Designers have found them adaptable to such an important degree that many of their creations have been successfully die cast where formerly other methods forbade their development. In this electrical equipment industry, vital usage is made of these parts die cast from aluminum and magnesium. The illustration above shows a few—electrical windshield wiper housing, electronics hose part, motor and bells and a motor field ring. Features that make these die cast parts practical include great cost savings through the virtual elimination of machining and finishing while at the same time maintaining precision standards. Tough and strong, the alloys have the dimensional stability required for maintaining bearing fits and tolerances. Parts such as these give adequate dissipation of heat through their high thermal-conductivity as compared to other materials. With the freedom of design permitted, greater scope is allowed the designer to easily add such features as heat dissipating fins.

Let's Talk It Over . . .

LITEMETAL DICAST, INC., is an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs—little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large structural parts. Complete facilities for secondary operations are also available.

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PLANT AND EXECUTIVE OFFICES

For more information circle No. 43 on the Reader Service Card

GYRO FLYWHEELS

continued from page 43

After the fly-wheel has been removed from the die, the sprue is broken off and the rough wheel goes to the trimming lathe shown in Figure 3.

As the wheels are cast, the spokes do not need any trimming nor does the hub. The rim, however, must be cleaned up. This operation is done with one set-up using tooling that does the entire job with three cuts. The face of the wheel is first machined with a form tool, followed by a cut on each side to shape the rim properly and blend the face into the sides at the desired curvature.

Surface finishing, purely for decorative purposes, is the last step before assembly and packing. The face and the two rims are painted as is the hub. Two wheels are mounted in the finishing jig which is so arranged that the entire rotating head can be moved about a vertical axis through a wide enough angle so that the hubs, both inside and outside, can be reached easily by a hand-held brush.

To make this rotation simpler, and to keep the cost and complexity of the machine down, a very long belt from an overhead jack shaft is used. The head is thus easily rotated and the spring back of the belt brings the unit back to normal operating position smoothly and easily. As a rule, the rim and the hub are painted in different colors.

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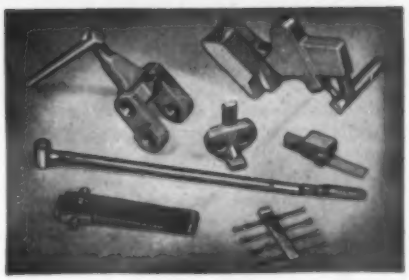
Investment Casters *Prefer* **VAN DORNS** for molding styrene patterns



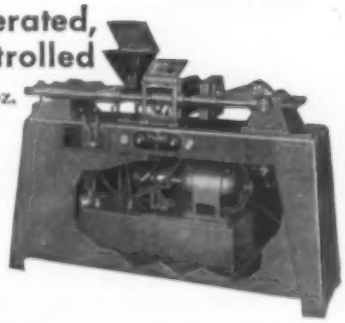
Typical precision parts produced by investment casting, using styrene patterns molded to .003" tolerances on Van Dorn Presses.

2½ oz. Automatic and 2 oz. Semi-Automatic Presses

These injection presses feature safe, simple push-button controls. Accurate temperature regulation. Rugged, compact, quiet.

MODEL H-250

Power-Operated, Lever-Controlled Presses — 2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder — grinds up waste, rejects, etc., for re-use.

MODEL G-100

Mold Bases for these presses available from stock.

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Write for information on this equipment.

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Cable Address: "VANDORN" Cleveland

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For more information circle No. 68 on the Reader Service Card

The blades then are automatically indexed into the rinse cabinet and around to the original loading section where they are manually unloaded.

The Cro-Plate Co., Inc.
For more information, circle No. 211 on the Reader Service Card

AIR MOTOR ... features air cushioning

A newly designed air motor with a 2½" bore that features air cushioning at either or both ends was recently announced.

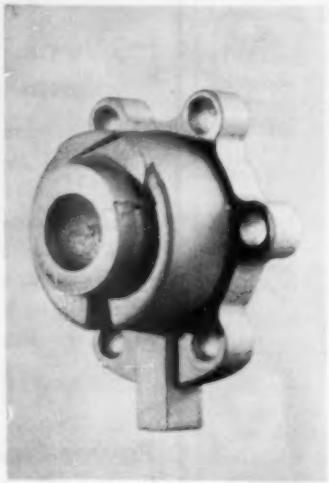
The unit has a built-in 4-way valve and speed controls; the valve is available for either 8 or 120 volt momentary contact, 12, 110, 220 or 440 volt maintained contact control; direct mechanical or manual control; air-pilot valve control; and air poppet valve control.

The motor is available in all standard mountings. It operates at air pressures up to 175 psi and develops a thrust equal to five times the applied air pressure. The cushioning is adjustable and is effective on the final ¾ inch of the stroke.

The Bellows Co.
For more information, circle No. 216 on the Reader Service Card

Are You Investigating Costs?

INVESTMENT CASTING MAY BE YOUR ANSWER...



This housing for a non-lubricating lift plug valve is cast in 4140 steel. It is annealed and normalized prior to machining and final heat treatment. If the part were made from bar stock or a forging, scrap losses would be very high and machining costs would be multiplied many times over that now needed to finish this 1½-pound investment casting.

If the rising costs of materials and labor have you concerned, you certainly ought to investigate investment castings. A good place to start your investigation is any part on which multiple machining operations are now required. Your re-evaluation will point out the ways that investment castings can save production dollars: close tolerances, fine surface finishes and soundness are assured. And complete quality control facilities are available to safeguard your savings.

INVESTMENT and SHELL MOLD CASTINGS,
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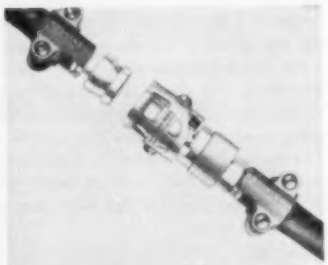
For more information circle No. 39 on the Reader Service Card

QUICK CHANGE COUPLING ... for air lines

A new air-line coupling for connecting tools to air lines is reported to allow ultra-fast tool changing with complete safety to the operator.



Valve Coupling Locked in "Off and Exhaust" Position

The coupling is so designed that the act of disconnecting a tool from the line automatically shuts off the air and exhausts any high pressure air in the tool before complete separation can be accomplished. When a tool is connected the air can not be turned on until a positive connection is made.

Another advantage reported for this coupling is that the tool can be swiveled without danger of leakage or without kinking the hose.

C. B. Hunt & Sons, Inc.
For more information, circle No. 213 on the Reader Service Card

AUTOMATIC SLUG CASTER ... for forging or extrusion

Recently introduced is an automatic slug caster for producing aluminum slugs for impact extrusion or forging purposes. The machine produces these slugs directly from the melting furnace without any intermediate steps or handling of molten metal.

The machine has a pan and a water-cooled mold, both of which enter the furnace well. The aluminum enters the mold through a gate in the pan, and after a cooling cycle, is passed for solidification. The pan and mold shift to shear off the solidified gate, then as both rise from the metal, they separate permitting the slug to be ejected down the chute from which it would be set into tote pans, onto conveyors, etc.

Various sized slugs can be cast. As an example of the machine capacity the builders quote 2,000 to 3,000 pieces per hour of one inch diameter by one inch long slugs.

Stromen Furnace & Engineering Co.
For more information, circle No. 218 on the Reader Service Card

MELTING PRACTICE
continued from page 33

If elements of group A are present in remelt scrap, or in the master melt, losses will range from 50 to 90 percent, depending on melting conditions. Losses of elements in group B on remelting will range from 5 to 20 percent of the initial amount. Losses through oxidation will be greater in actively stirred induction melts and will be greater the longer the time and the higher the temperature.

In carbon-arc melting, carbon and nitrogen pick-up and nitrogen pick-up in induction melting will be greater the greater the amount of the strong carbide or nitride forming elements in group A, chromium, titanium, zirconium, vanadium, tantalum, and columbium, and the higher the temperature.

Once a molten bath of metal is present, the rate of oxidation of most of these elements decreases slightly since the reactivity of the pure metals with oxygen at a given temperature is generally greater than its reactivity when dissolved in another metal. Furthermore, less of the metal is exposed at any one time to atmospheric oxygen when the metal is dissolved uniformly in another metal solvent.

In charging a furnace with metal for melting, the following features must be observed:

1. Freedom from oxide (scale as well as ceramic oxides). Sand blasted, preferably, or pickled stock (danger of hydrogen pick-up) is advised.
2. Dry charge. Oxides, scale or rust will hold large amounts of water vapor. Stock which appears dry may be quite high in water content adsorbed on the surface. The danger of moisture is, of course, in the introduction of hydrogen into the melt. Risers and all other hollow porous scrap are especially dangerous and are best omitted from the charge unless it is specifically dried at 300 to 400° F before charging.
3. Select the charge to obtain maximum density of packing for induction melting to obtain most rapid melting. Uniform stock is preferred and

Continued on page 72

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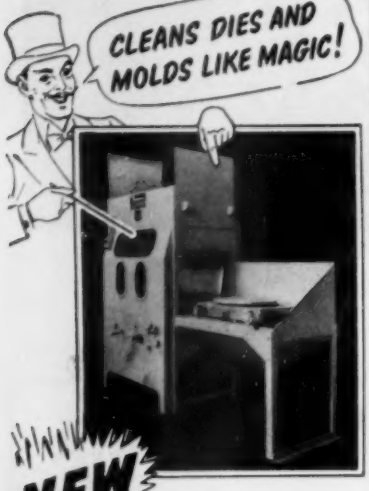

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For easier handling, for added efficiency . . . look to the new Pangborn Hydro-Finish! Hydro-Finish cleans and finishes molds and dies in minutes, holds fine tolerances. And now it offers many new advantages! Pangborn has done away with the pump; air jet sluriators now keep the abrasive in suspension. This means a lower investment and fewer moving parts. Optional equipment includes a loading stand that simplifies handling, washing and inhibitor application. The cabinet has been redesigned for more efficient operation. These and other advantages make the Pangborn Hydro-Finish ideal for precision cleaning and finishing!

For further details on Hydro-Finish, send for Bulletin 1403 now! Write PANGBORN CORP., 3500 Pangborn Blvd., Hagerstown, Maryland. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

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BLAST CLEANS CHEAPER

Circle No. 79 on the Reader Service Card

MELTING PRACTICE—cont.

generally results in a minimum tendency for bridging.

4. In gas melting, the dangers of oxidation are greater when the hottest oxidizing flame is used; and hydrogen pick-up from the water formed during combustion is a danger with a somewhat reducing flame.

5. In a carbon arc furnace, the losses due to oxidation are somewhat minimized but are still relatively large for group A metals. Hydrogen pick-up is a definite danger in the more reducing atmosphere of the carbon arc furnace.

6. If slags could be used safely and conveniently, it would be desirable to melt under such a protective cover to guard against oxidation losses. Using dry charges, the dangers due to hydrogen could also be minimized. Protective gas atmospheres of the inert variety are best and can provide some protection against both oxidation and hydrogen pick-up.

Deoxidation

Inasmuch as the group A elements oxidize most readily, they are the best deoxidizers in the same order, within limits which will not be discussed here. There are, however, large differences in the other characteristics of the group A elements when added to metals.

Calcium, magnesium and *cerium* not only deoxidize well but they *do not leave* a strong, continuous oxide skin on the surface of the melt. Less protection is afforded with time, but the pouring characteristics are vastly better. It must be remembered that calcium and magnesium react almost explosively if they are not plunged under the metal surface.

Aluminum and *titanium* leave a strong oxide skin over the metal surface, making pouring a bigger problem, and result in entrapment of these skins in the casting.

Tantalum and *columbium* behave well in all respects but are too expensive to use as deoxidizers (*also beryllium*).

Silicon is one of the poorer of the group A deoxidizers and generally leaves a glassy slag when combined with some other oxides such as FeO, MnO, or Al_2O_3. In combination with Ca to form cal-

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cium-silicon or calcium manganese-silicon alloy, a fairly stiff, solid deoxidation product can be formed which is based on the high melting $2CaO.SiO_2$ compound.

On small melts the actual deoxidation power of a deoxidant as measured by the free energy of formation of its oxide is much less important than one or more of the following features:

1. How fast does the deoxidizer melt into the metal bath?
2. Does it melt in, or does it react violently as do magnesium and calcium in contact with air at high temperatures?
3. Does the deoxidizer leave a clean metal surface, a powdery dry oxide, a molten glassy slag, a solid fused slag or a thin skin?
4. Does the deoxidizer react with the crucible?
5. Is the density high or low; is the melting point high or low?

Small heat deoxidation must deviate from melting and pouring practices common to large heats wherein surface requirements are less critical and the final product is machined or is a rolled or forged product.

The deoxidizer must be *plunged* under the metal surface where it can react safely out of contact with the air.

The preferred deoxidizer for much of the work should be calcium-manganese-silicon and calcium-silicon alloy, cerium alloys (Misch metal and others) and silicon because they leave a clean surface. Pure calcium or magnesium are effective when used exactly correctly, but may otherwise be dangerous. A useful practice is to deoxidize with a small amount of silicon, clean off the glassy slag and then complete the deoxidation with calcium-silicon metal or cerium Misch metal.

Implied throughout this presentation is the need for *close temperature control*. Oxidation losses increase with increasing temperature because metals dissolve more oxygen at higher temperatures. Accordingly, the melt should never be uncontrollably overheated. But more important is that there is no way of gaging losses of oxidizable alloying elements during melting if melting times and temperatures vary significantly from melt to melt.

Immediately prior to adding oxidizable elements and deoxidizers, the temperature should be controlled reproducibly. In adding elements of the group C metals (above), no losses need be considered. In adding the other groups losses will be experienced in proportion to time-temperature factors.

JACK BEAN ORGANIZES NEW METAL COMPANY

Jack Bean who recently resigned as president of Michigan-Standard Alloy Casting Company (formerly Michigan Steel Casting Company) announces the formation of the Jackson Metal Company located at 17622 James Couzens Highway in Detroit, Michigan. The principal activities of this new company will be buying and selling most grades of ferrous and non-ferrous scrap, specializing particularly in nickel — chrome — cobalt bearing materials.

ROTO FINISH

it's the finish that counts!

Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

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- **SMOOTH SURFACES.** Surface variations held to 125 micro-inches or better.

FOR PRICE

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- **REDUCED MACHINING COSTS.** Smooth, accurate castings greatly reduce or eliminate machining costs.
- **SHORT LEAD TIME.**

ADAPTABLE TO MANY CASTING SIZES AND ALLOYS — casting weights up to one hundred pounds or more. Carbon steel, conventional low alloys, stainless steels and the superalloys.

SEND US YOUR BLUEPRINTS. Our sales engineering department will show you how the revolutionary Lebanon CERAMICAST Process can be adapted to your project design.

*produced under licensing agreement with Shaw Processes, Ltd., London, England.

CIRCLE L

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CARBON, LOW ALLOY AND STAINLESS STEEL CASTINGS

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FLUXES
continued from page 42

solution as it will not have had time to precipitate out before the metal solidified. Depending upon the solidification rate, consistently gas free castings can only be obtained by the removal of the hydrogen before the metal is poured. The dissolved hydrogen can be removed by mechanical or a combination of mechanical and chemical methods.

In principle, any gas or any material which produces a gas which is basically insoluble in aluminum can be used to remove the hydrogen. Two commonly used materials are chlorine gas and nitrogen gas. Chlorine is probably the most efficient remover of contained hydrogen as its action is both chemical and mechanical.

As the bubbles of chlorine rise in the metal bath they become attached to the hydrogen bubbles and bring them to the surface where they are expelled into the air. Since chlorine is a very active material, it can attack and cleanse the metal at the same time, which in turn helps to remove the hydrogen from the metal.

However, chlorine is very dangerous and extreme care must be exercised in its use. Many foundrymen believe that the advantages obtained from its use do not justify the precautions which have to be taken.

Nitrogen, on the other hand, being a relatively inert material exerts only a mechanical action in the removal of hydrogen. Under certain circumstances the use of oil pump nitrogen can effectively remove hydrogen from a melt. All too frequently the expected results are not obtained. Even under ideal conditions, the length of time required for complete degassing with either chlorine or nitrogen and especially nitrogen is excessively long.

To overcome the disadvantages of using these gaseous fluxes, many foundrymen prefer to use a proprietary degassing flux mixture for their hydrogen removal. Many compounds such as hexa chloroethane, hexachlorobenzene, sodium and potassium silicofluoride, sodium and potassium fluoborate, sodium and potassium ti-

tanium fluoride, aluminum chloride and magnesium chloride can be used.

Of course all of these materials must be free from moisture when they are used, but normal precautions are all that are needed to keep the fluxes in satisfactory condition. Usually two to four ounces of the flux compound is added to each 100 lbs. of the metal, by either a compressed pellet or wrapped up in aluminum foil. The flux is plunged to the bottom of the pot or crucible and held there until the bubbling action is expended. Usually one application is sufficient to reduce the gas content to a satisfactory level.

If further degassing is required, another application can be made. The entire cycle generally does not take more than three to five minutes. This is considerably less time than is required for either chlorine or nitrogen fluxing.

The use of chlorine gas has a tendency to coarsen the grain of the metal. Many of the proprietary degassing fluxes contain a grain refining material which in addition to producing a degassing action actually refines the grain of the melt at the same time. This is a decided advantage which can not be obtained when degassing except by the use of these special salt fluxes.

There are times when freedom from gas porosity cannot be determined. In permanent mold and die castings having thin sections, trouble is sometimes encountered with shrinkage if the metal is gas free. In such cases the addition of hydrogen to the melt, in contrast to practices described above, many times eliminates the defect. Since the sections are thin, the porosity does not show in the castings as the hydrogen is retained in solution. The reason the increase in hydrogen helps eliminate the shrinkage is that the dissolved hydrogen precipitates out enough to act as a block and in effect stops the shrinkage from forming in a continuous channel. There may be just as much shrinkage present in the casting, but it is dispersed and is not detrimental. Hydrogen can be added to the metal in a controlled manner by using one of the proprietary gassing fluxes which are on the market. It is often desirable to add one or two ounces per 100 lbs. of metal to insure uniform casting characteristics.

Improvement Fluxes

The ultimate in soundness and mechanical properties from a casting can be obtained only if the metal is free from dross and foreign inclusions, free of dissolved hydrogen and has fine grain size. We have covered the first two and would now like to discuss the last requirement.

Other things being equal, the grain size of a casting is finer with a faster solidification rate. Sometimes even with a relatively fast cooling rate, the grain size is not as small as desired. Excessive fluxing or extended holding at elevated temperatures can destroy or reduce the nucleators required for fine grain size. It is necessary to replenish the many nuclei which have been destroyed to obtain fine grain.

It is possible to do this by adding a small percentage of some of the elements which are insoluble in aluminum such as boron, titanium, and zirconium. All three have been used separately and in combination with each other. The grain refining addition can be made by metal riches or

Continued on next page

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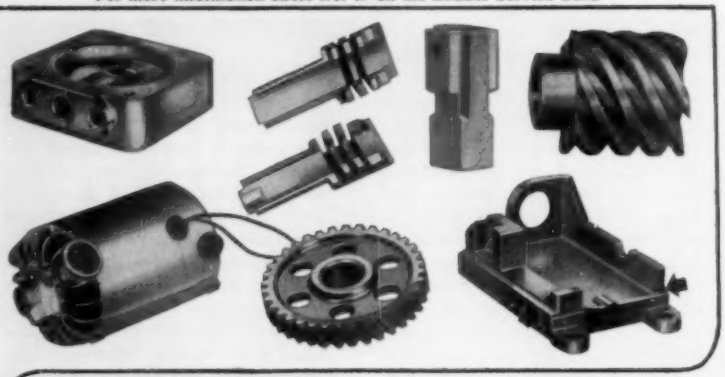

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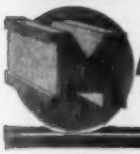

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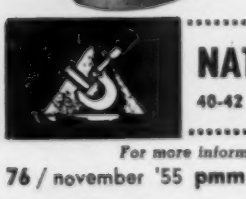

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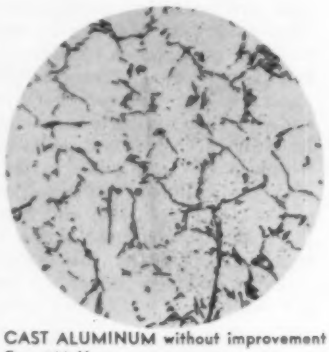
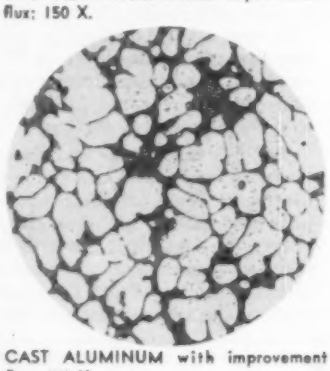
with sodium or potassium salts such as the fluoborates, the titanium fluorides, and zirconium fluoride.



CAST ALUMINUM without improvement flux; 150 X.



CAST ALUMINUM with improvement flux; 150 X.

Economically it is usually desirable to use the salt fluxes as many of the metal riches are made from these salts and naturally more expensive. Although these salts can be added to the metal bath separately, it is believed that the best results can be obtained by a mixture of the salts. This is particularly true of the aluminum-silicon-copper alloys in wide use today.

It is usually easier and cheaper to obtain a pre-mixed combination from a reputable supplier as the labor cost of mixing small batches is usually high. As almost all of the grain refining fluxes contain salts which produce an insoluble gas when immersed into the bath, the additional benefit of limited degassing is also obtained from these grain refining fluxes.

The grain refining fluxes are used in a manner similar to that of the degassing fluxes. They are usually sold as pellets, or can be wrapped in aluminum foil and plunged to the bottom of the melt. Approximately two to four ounces per 100 lbs. of metal is used. It is sometimes desirable to divide

the total amount required into two or three portions and make separate additions. Higher recovery of the grain refining elements is obtained if this procedure is followed.

To summarize it can be said that improved efficiency can be obtained in the smelting operation by using an ignition type flux which will lower the melt loss, lower labor costs and result in cleaner furnaces. Efficient degassing can be obtained with salt fluxes in less time and with greater assurance than is possible with gaseous fluxes. Compounded grain refining salt fluxes result in excellent grain refinement at a lower cost than is usually possible with metal riches.

SILICA GLASS
continued from page 37

Tooling and Equipment: Simple, inexpensive patterns from which the porous plaster molds are made have proved to be entirely practical. A type of dense plaster is used for this purpose, permitting very short lead time and low cost for pilot and experimental work.

Where short production runs are scheduled, a soft metal die could be used, similar to those used commonly by investment casters. For longer production, machining a set of metal dies from brass or any other dimensionally stable metal, is economically feasible.

One common variable that must be calculated into investment casting tools that can be eliminated in using the silica glass material is the allowance for dimensional change in patterns and molds. The Glascast process requires only allowance for normal metal shrinkage, none for dimensional changes in the patterns or molds.

Undercuts must be eliminated, and adequate draft allowance must be made. Maximum draft allowance seldom exceeds five percent. Depth of draw and complexity of shape will determine individual draft requirements.

Besides the pattern, relatively simple equipment is used for the Glascast process: A high speed mixer for mixing both the plaster

Continued on page 79

aluminum . . .
▶ permanent mold castings
▶ die castings

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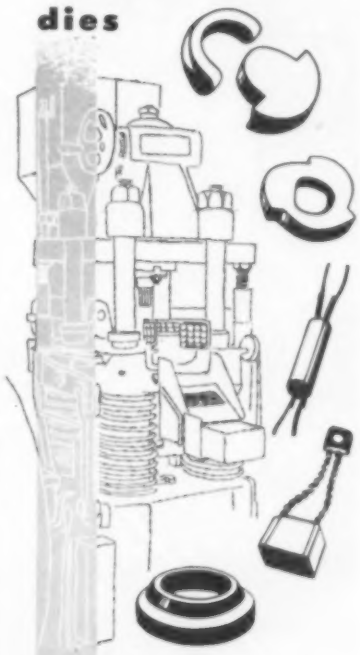

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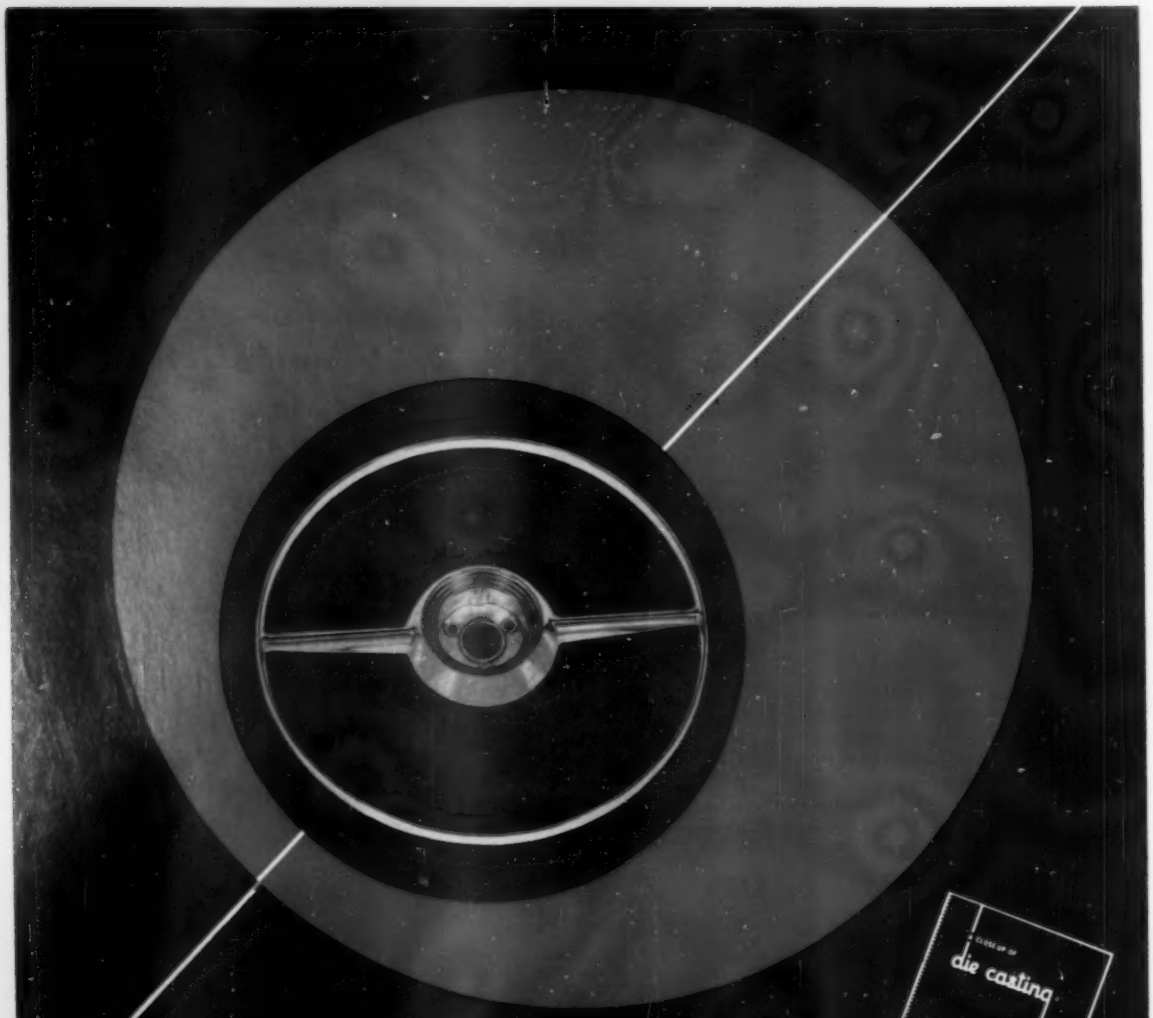

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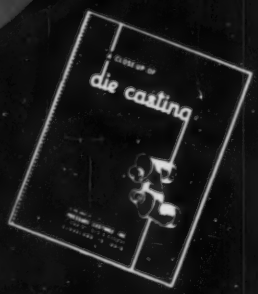

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Cont. from page 77

and the Glascast powder; Drying ovens (105-300 F); Furnace (2000 F); Scales; Mixing containers; and such materials as dense and porous plasters, mold release, etc.

Basic material for the process is the Glascast powder, which is vitreous rather than crystalline, and has an approximate composition of 96% SiO_2, 2.5% B_2O_3 and 1.5% others. Its coefficient of expansion from 0 to 578 F is .00000047 in./in./°F.

Why Glascast? Some of the special advantages of this process, as outlined by the company, include the following factors of interest both to the foundry and the casting buyer:

1. Good surface quality, 40-50 microinch finish without pitting.
2. Fine definition, held within .020.
3. Close dimensional control, within ±.005.
4. Low scrap factor, averaging 10 to 20 percent.
5. Low tooling costs, permitting short runs and design changes.
6. Very low coefficient of expansion, simplifying dimensional calculations.
7. No precoat is necessary.
8. Very rapid preheat, five to ten minutes at 1600-1700 F.
9. Suitable for high temperature alloys, up to 3300 F without contamination.
10. Suitable for all casting methods, gravity pour, centrifugal, pressure or vacuum.

DESIGN FOR APPEARANCE

continued from page 31

The pendulum type of dispenser has a valve mechanism built in that is also die cast. This valve is shown in Figure 1. Here, one of the advantages of the die casting process is clearly shown. The fixed member on which the ball valve pivots is cast as a separate unit with the pivot holes cored and the rivet hole cored. The cap, itself, has a zinc pin cast on and to assemble, the small casting is positioned in the cap and the zinc pin peened over to act as a rivet. The ball shaped valve part is also die cast with the pivot holes cored.

Assembly of this valve is done by the die casting company prior to plating. As is apparent from the assembly of the pendulum dispenser, use of the elastic properties of the zinc alloy is made to hold the swinging member in the bracket.

After trimming to remove gates, risers and flash, the parts are shipped directly to a job plating concern and then to the Ampion Corp. for assembly and shipping.

SELL SHELL MOLD UNITS IN EUROPEAN MARKET

The entry of mass-produced American-built shell molding equipment into the European market is foreseen in an announcement by Frank K. Shallenberger, president of Shalco Engineering Corp., of a new European sales and service company.

Mr. Shallenberger announced the formation of Shallway International Corporation, with rights to the sales and service of Shalco shell molding machines, Shalco shell core machines, and certain other items of Shalco shell molding equipment and accessories. Head offices of Shallway International Corporation will be in Palo Alto, California.

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has been improved to give your metal more fluidity and to prevent sluggishness. Zincorex "DT" does away with obnoxious ingredients, will not absorb water, reduces fumes. Application of Zincorex "DT" gives you:

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MACK TRUCK Specifies Epco INVESTMENT CASTING for Vital Part

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INVESTMENT CASTINGS IN ANY CASTABLE ALLOY EXCEPT MAGNESIUM

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EPCO Cast in SAE 1045 steel ready for use except for tapping of ¼-20 thread, the lever was made at less cost and well within Mack's high quality standards.

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Not only is the original cost extremely low, but operating costs are so low that the machine will soon pay for itself. Actual tests operating 8 hours a day, 5 days a week, show total cost of gas and electricity of ONLY 17 CENTS PER HOUR!

Other outstanding features include — all steel welded construction — 80 ton locking pressure — automatic electric cycling at high speed —17-¾" x 17-¾" die platens — 6½" die stroke — highest grade controls and valves mounted for easy maintenance and accessibility — a complete package with self contained unit.

Available in Air or Hydraulically operated plunger goose-neck type for zinc, tin or lead, or, cold chamber type for aluminum, brass and magnesium.

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NAMES IN THE NEWS
continued from page 27

to the position of project engineer developing magnetic memory devices and allied equipment was also announced.

The appointment of **Robert W. Sullivan,** as senior metals processing engineer, was announced by *General Electric Company.*

Alan Wood Steel Company announced the appointment of **C. Irwin Hochhus** as plant manager of the company's new Penco Metal Products Division.

Walter E. F. Mansfield has been named district sales manager, New England district, for textile sales of *Celanese Corporation of America,* succeeding **Bartlett Guild,** who is retiring after 30 years service with the company.

Vascaloy-Ramet Corporation has announced the appointment of **George W. Miltimore** as office manager of their Detroit office.

Bertram F. Ames, general sales manager of *Maas & Waldstein,* has been appointed chairman of the Industrial Product Finishes Committee of the *New York Paint, Varnish & Lacquer Association.*

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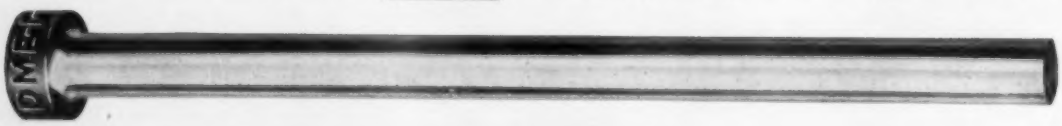

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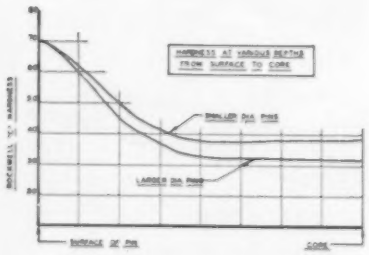

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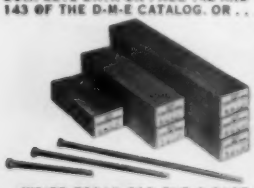

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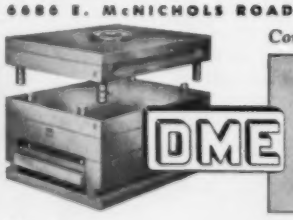

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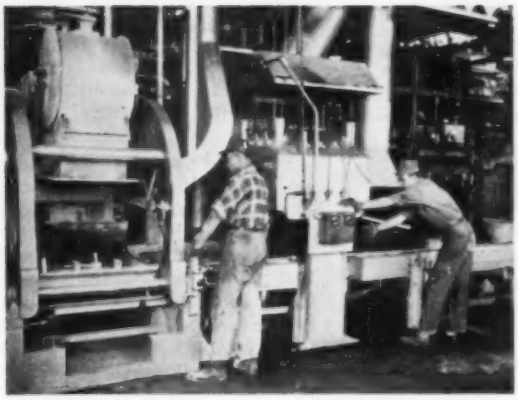

PREHEATED PATTERNS are charged with sand, the excess dumped (left) and then cured (right) to form a resin bonded shell.

A COMPLETED MOLD must have the two halves fastened together. Here the separate halves are fastened together in a battery of air operated presses.

Intermixed shell and sand molds in conveyorized foundry give

A Choice Of Casting Methods For Engine Parts

As more companies gain knowledge and experience, the shell molding process is becoming more and more widely used to implement existing sand foundry facilities. During the very early stages of investigation and use of this process, many of the more enthusiastic proponents predicted that the process spelled the end of the conventional green sand molding methods. Nothing, of course, could be farther from the truth. Where the method is applicable, shell molding shows some impressive manufacturing savings, but unless sound judgment is used, equally impressive losses can be chalked up.

At the Indianapolis, Ind., truck engine works of the International Harvester Co., investigative work, pilot plant operation and finally full scale molding of resin bonded shells has been the history that has led to what the company calls CONTOUR molding.

Where properly applied, the process has shown savings due to less metal poured in gates and sprues, less metal needed for final machining and hence less total machining, and lower cleaning costs on the castings. At the present time, only four parts are in production by this process — two exhaust seal rings and two exhaust pipe flanges. However, a number of other parts are being studied for possible application of the process.

The molding machine used was designed and built by International Harvester Co. In general, it follows the pattern of all shell mold making machines in that it

Continued on next page

FACTORS THAT AFFECT COST OF CASTINGS

The CONTOUR molding process, as practiced at International Harvester, requires a careful analysis of many factors before any assurance can be given that an overall saving will result. Because pattern costs are so much higher than for green sand casting (in one case about $2300 compared with $400 for green sand patterns) the part to be cast must be very stable in design. The present tendency, therefore, is to use this new process to cast only those parts that are reasonably sure of no design changes for several years. The speed of molding, that is, the number of completed molds per hour, is about 50 per cent greater than that for green sand molds; less skilled labor can be used so that the labor charges are considerably lower.

However, some initial costs of International Harvester's special process are higher than in conventional sand molding. The sand, resin and rather expensive parting compound cost more. Operating costs of the molding machine are also somewhat higher than those of a conventional sand slinger or molding machine.

As against these, and other, costs that are higher than green sand molding, there are a number of clear-cut savings.

Under ordinary operating conditions, the life of a pattern for green sand molding is about one year, using a jolt squeezer. Present indications are that the life of patterns for new molding process will be substantially indefinite. Also, the longer life of the patterns should result in little or no scrap loss due to pattern wear. No trouble is experienced in securing the detail required.

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FAST — even at lower furnace temperatures where other fluxes may fail.
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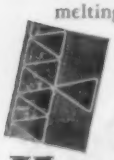
ECONOMICAL — you need less flux with Haviland . . . sometimes 50% less. You save both time and materials.

For free samples of Haviland fluxes for *your* zinc or aluminum melting operations, just drop us a line.



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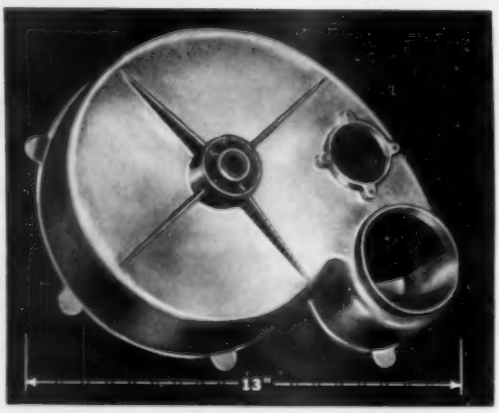

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CHOICE OF CASTINGS — con't.

uses a pre-heat oven, a roll-over dump box and a curing oven. There are, of course, numerous differences that have been incorporated to best handle the particular jobs encountered in this foundry.

The sand used for making the shells is standard clay-free bank sand with an AFS fineness of 100. The sand is purchased dry and must be maintained that way so that proper mixing can be accomplished. In general, the sand for this application costs about twice as much as that used for green sand molds. A portion of this increased cost is due to the purchases being made in smaller lots and a portion due to the more rigid specifications under which the sand is bought. Storage of the sand is in a weatherproof silo with a 500 ton capacity.

At present, 6 per cent of a phenol-formaldehyde type of resin is mixed with the sand. Three different resins have been standardized on and can be used interchangeably. No change in processing or procedures is necessary when shifting from one of these resins to another.

Mixing is in a Simpson muller with a 3000 lb. batch on a 15 minute cycle. Discharge from the muller is into a storage box directly over the molding machine.

The cycle for mold making requires 8 minutes, this is the time for a single 20" x 24" pattern plate to make a complete circuit through the machine. The pattern is preheated to a temperature of 450F to 500F in a two stage oven using both an infra-red ray oven and a gas heated oven. The heated pattern is clamped to the sand box of the roll-over dump type and a charge of approximately 100 lbs. of sand is dumped onto the pattern. The dump and rest period is 22 seconds which allows a mold build-up of from 3/16" to ¼", and the completed shell weight is approximately 10 lbs.

After the excess sand mix is removed, by returning the dump box to its rest position, the coated patterns moves to the curing oven. The cure is at 1,100F for 15 seconds. This oven is heated by a battery of 18 radiant flame gas burners so arranged that a uniform curing temperature is achieved over the entire mold. After curing, the mold is stripped from the pattern.

Following stripping, the pattern is sprayed with a mold release agent; a silicone type material is used, diluted 60:1 with water. The pattern then enters the reheat oven where it remains for 7 minutes.

The entire travel of the pattern is on a conveyor operating in a closed circuit and is long enough so that 12 standard plates can be in use at one time. Based on an 8 minute cycle, this gives one mold every 45 seconds when the machine is operated at capacity.

Both halves of a pattern are molded on the same plate so that when the mold is stripped it can be broken in half and the two pieces fastened together. All mold halves are fastened together with a polyvinyl adhesive, that requires three minutes under pressure to set and cure. Generally, a small amount of the phenol-formaldehyde resin is used to form a temporary bond while the regular adhesive is curing.

After the mold halves have been cemented together, the finished mold goes to the casting floor. No back-up of any sort is used and the shell molds are mixed indiscriminately with green sand molds on the casting conveyor. All of the molds made thus far are positioned so that casting is flat rather than on edge as is done in some foundries. This method is believed to give better metal distribution in the mold and completely avoids any method of supporting the molds during pouring. Shake out and clean up are the same for shell molded casting as for those made in green sand molds.

Shifting, swelling, bulging and the formation of a heavy flash at the parting line are common troubles when green sand molds are used. With the resin-bonded molds, horizontal shift is reduced to zero and if the proper grade of sand and resin is used and the mold correctly cured there is no trouble with swelling or bulging. The parting line flash is generally 0.010 thick or less.

Casting tolerances are, of course, a touchy subject. Many factors will determine how close a part can be cast. In general, however, production runs of the parts now being cast show that total dimensional tolerances *within a mold half* are about ± 0.015 at the most.

Of course, one of the outstanding reasons for the use of this molding process is the reduction in machining costs. Of the four parts currently being cast in this manner, all machining other than to grind the residual sprue off has been eliminated.

COPPER IN IRON
continued from page 45

than copper provided they have a mutual solubility with the iron. Figure 15 shows the dimensional changes obtained when iron powders A, B and C are mixed and sintered with varying amounts of ferrophosphorous (20% P), which has a liquid phase eutectic at 1050 C (1925 F). The diagram may serve as an illustration of the shrinkage factor alone.

Further evidence will be found in the following experiences: Prolonged heat treatment of an iron powder at higher temperatures leads to a decrease in specific surface, increase in size of the individual pores as well as disappearance of surface irregularities. Such a heat treatment will increase copper growth of iron powders.

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COPPER IN IRON—cont.

Densification of iron powders by severe milling likewise will increase its copper growth.

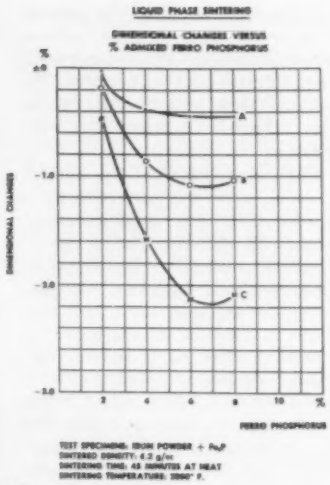
Summary

The factors influencing dimensional changes of sintered iron-copper compositions have been reviewed, and the results of a number of practical tests have been reported.

The factors causing growth and the factors causing shrinkage during sintering have been regarded separately, and an approach to theoretical treatment of the subject has been suggested.

Special consideration has been given to the case where the copper addition is below the solubility limit of copper in iron at sintering temperature, and it has been shown, that the dimensional changes are closely related to the particle characteristics of the powder and the duration of the liquid phase.

Most of the above described work has been done in the laboratory of the Hoeganaes Sponge Iron Corp. in Riverton, New Jersey. Gratitude is expressed to Dr. N. H. Brundin of the Hoeganaes Billesholms AB, Sweden, for valuable criticism and help with the dilatometric tests and to J. F. Sachse and J. Haertlein of the Metals Disintegrating Co. for study the specific surface problem.



15. Liquid Phase Sintering

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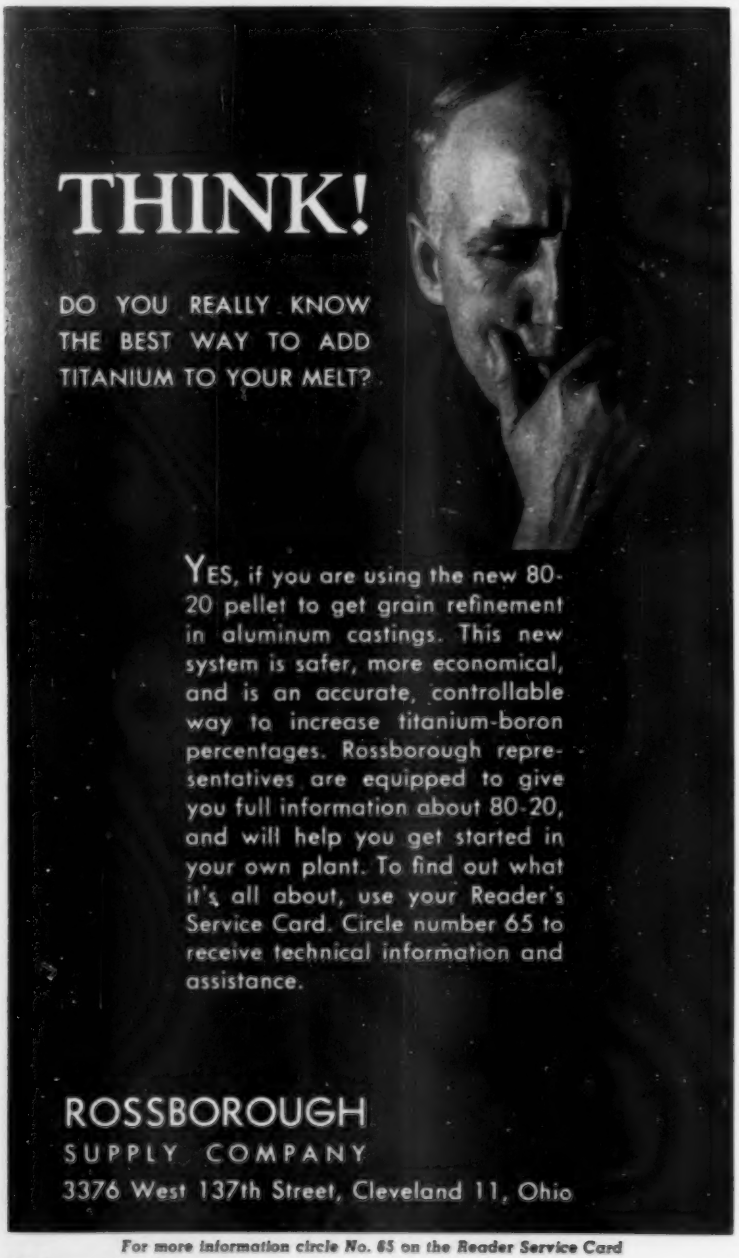
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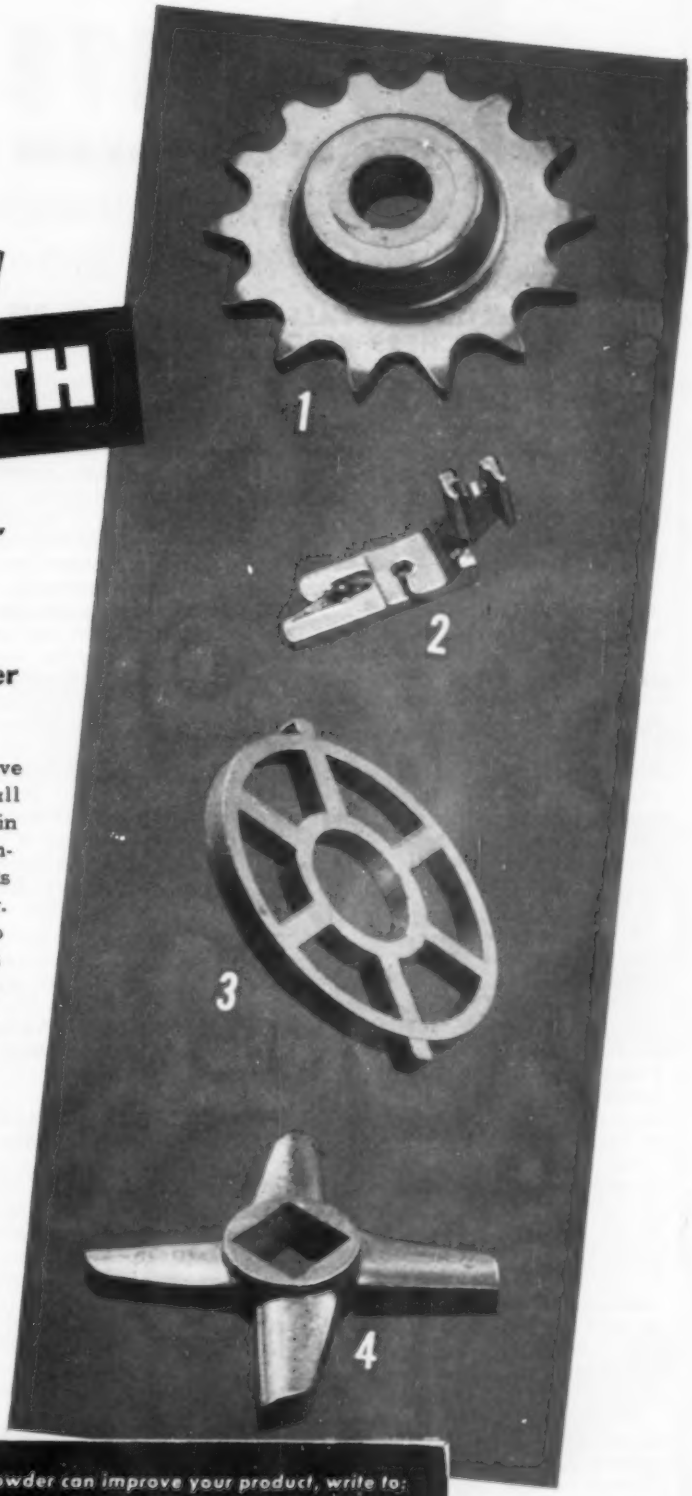

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NEWS OF INDUSTRY AND ASSOCIATIONS

HIGHER MELTING METALS MAY SOON BE DIE CAST, RESEARCHERS REPORT

The imminence of economic production of brass die castings due to the development of improved die materials was reported during the closing hours of the three-day annual meeting of the American Die Casting Institute.

At the special session of the Die Casting Research Foundation—an organization founded by the American Die Casting Institute to sponsor research leading to improvement and broadening of the die casting process—it was announced that encouraging progress in the development of improved die materials should allow the economical production of copper-base alloys within the next few years. Discussion centered on the importance of this development, as well as on commercial availability of the die material.

Other valuable results of the Die Casting Research Program were revealed with the announcement that improved die lubricants have been developed and are in the field testing stage.

The importance of these research activities emphasizes the growing support that the die casting industry is giving the Die Casting Research Foundation. It is also reflected in the announcement made at an earlier session that job shop membership in ADCI is now at an all time high—with well over 100 companies claiming membership.

E. V. Blackmun, assistant chief metallurgist, Castings Division, Aluminum Company of America, was elected to the board of trustees of the Die Casting Research Foundation. All other Board members continue in office.

YALE & TOWNE EXPANDS POWDER METAL WORK

The purchase of a new plant at Addison, Ill., to be added to the facilities of the Powdered Metal Products Division of The Yale & Towne Manufacturing Company, has been announced by Gilbert W. Chapman, president.

The newly acquired plant will be operated as the Addison plant of Yale & Towne's Powdered Metal Products Division of Franklin Park, Illinois, of which George L. Bachner is general manager. It will be principally devoted to the production of ferrite components used by the manufacturers of radio, television, and other electronic equipment.

Ferrites are sintered mixtures of iron oxide in combination with varying quantities of other oxides. Because of their electrical properties, they have proved valuable in the production of such components as transformer cores and deflection yokes for television sets.

Located on a two-acre plot, the new plant was constructed in 1954. It contains 12,300 square feet of floor space.

Production at the Addison plant was scheduled to begin on October 1.

PRODUCES COBALT ALLOY CASTINGS IN SHELL MOLDS

Contract production of small shell-molded castings of cobalt-base alloys and other non-ferrous and ferrous alloys is now offered by Crobalt, Inc., Ann Arbor. The company has complete equipment for making shell molds up to 14" x 18" pattern size, together with pattern-making facilities, electric arc furnaces and cleaning equipment. Present capacity is 1500 lbs. per shift.

This new service is based on 23 years experience in producing cast alloy tool bits and similar parts. The company also offers development engineering service on casting applications. Details are available on request from Crobalt, Inc., 2800 S. State St., Ann Arbor, Michigan.

NEW DIRECTORS, OFFICERS ELECTED AT PRECISION

Precision Castings Co., Inc., custom die casters of aluminum, magnesium and zinc, with headquarters at Syracuse, announces election of the following new officers and directors:

E. H. Heckett, chairman of the board, and director; William J. During, president, and director; J. J. Punke, senior vice president, and director; A. G. Lintel, vice president, and director; J. T. Simpson, director; D. M. Horner, director; Ross W. Castle, vice president, and director; William J. During, Jr., secretary, and director; Stanley Emerick, treasurer; Ray Hust, asst. secretary, and general counsel; A. D. Weigolt, vice president Cleveland plant; E. A. Dunning, vice president Cortland plant; Stanley Frost, vice president Kalamazoo plant; A. G. Chase, honorary chairman.

W. J. During J. T. Simpson

Precision Castings was acquired as a subsidiary of The Harrisburg Steel Corp., Harrisburg, Pa., last July. Messrs. Heckett, Simpson and Horner are also officers and directors of the Harrisburg Steel Corp. A. G. Chase was formerly board chairman at Precision. William J. During, who became president of Precision in 1953, continues as president and general manager of Precision under the new ownership.

DIE CASTING ENGINEERS FORM NEW CHAPTER IN WESTERN MICHIGAN

A new chapter of The Society of Die Casting Engineers was officially formed when the Western Michigan group was awarded a charter at a recent meeting held in Grand Rapids, Mich. On hand to make the presentation in behalf of the parent group were two officers from society headquarters: George Griffenham, secretary, and Mike Tenenbaum, treasurer.

The new unit represents the first expansion for The Society of Die Casting Engineers since its formation as the Detroit No. 1 Chapter on October 4, 1954.

Officers of the Western Michigan No. 3 Chapter for the calendar year 1956 are: chairman, James Thorpe, vice-president-engineering for Nelson Metal Products, Inc.; secretary-treasurer, C. Herbert Lloyd, Western Michigan representative for E. F. Houghton & Co.; and librarian-historian, C. Nelson Smith of Production Aluminum Company.

The new chapter will tentatively make its headquarters in Grand Rapids, Michigan.

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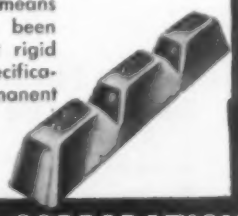

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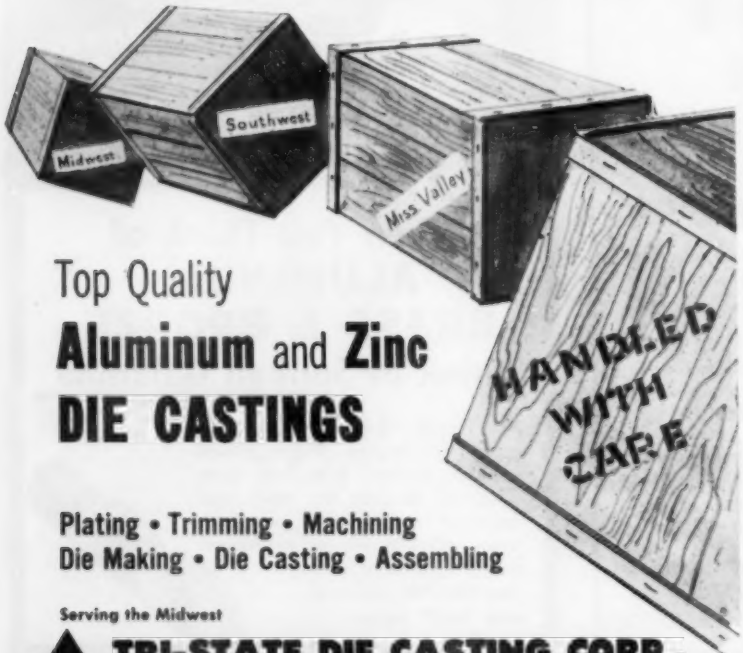

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DIE CASTERS RE-ELECT TOP EXECUTIVES

Top executives of the American Die Casting Institute were re-elected at the Institute's Annual Meeting in September. All of the officers—from president through the board of directors—have the same all-important basic qualification: They are policy making executives with practical die casting industry experience.

William J. During, president, Precision Castings Co., Syracuse, N.Y., was re-elected President of ADCI for the 1956 term. George Ralls, president, Pressure Castings, Inc., Cleveland, Ohio, was re-elected vice-president. David Laine and W. J. Parker were re-elected secretary and treasurer, respectively.

The national board of directors is elected by the four ADCI regional groups. Its members serve three year terms.

Pacific Coast Regional Group directors are: J. C. Bennett, (1956) Anderson Die Casting and Engineering Co., Los Angeles, Calif.; R. R. Dreibus, (1957) Harvill Corp., Los Angeles, Calif.; and A. W. Simpson, III, (1958) Western Die Casting Co., Emeryville, Calif. (Figures in brackets indicate term expiration dates.)

The Eastern Regional group directors are C. J. Sheehan, (1956) Aluminum Company of America, Garwood, N.J.; W. G. Newton, Jr., (1957) Newton-New Haven Co., New Haven, Conn.; and W. J. During (1958) Precision Castings Co., Syracuse, N. Y.

Walter Brown, (1956) Kiowa Corp., Marshalltown, Iowa; C. W. Omann, (1957) Advance Tool and Die Casting Co., Milwaukee, Wisconsin; and John Kraus, (1958) Racine Die Casting Co., Racine, Wisconsin, are the representatives of the Midwestern Regional Group.

The Central Regional Group board members are H. H. Weiss, (1956) The Superior Die Casting Co., Cleveland, Ohio; George Ralls, (1957) Pressure Castings, Inc., Cleveland, Ohio and R. A. Luedtke, (1958) Schultz Die Casting Co., Toledo, Ohio.

The Institute's directors-at-large were re-elected to serve for 1956. They are E. L. Anderson, Globe Imperial Corp., Rockford, Ill.; C. L. Anthony, The Hoover Co., North Canton, Ohio; Frank J. Koegler, Doehler-Jarvis Division of the National Lead Co., Toledo, Ohio; and L. G. Vander-

hoof, Stewart Die Casting Division of Stewart-Warner Corp., Chicago, Illinois.

Ex-Officio members of the Board are Austin T. Lillegren, Madison-Kipp Corp., Madison, Wis., past national president, and David Laine, secretary, American Die Casting Institute.

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WINS ASM SCHOLARSHIP

An outstanding student in metallurgical engineering has been awarded the American Society for Metals $400 tuition scholarship at Illinois Institute of Technology.

John L. Ledman, 6521 S. Morgan Street, Chicago, a sophomore, is recipient of the award, which will provide $200 toward tuition in the fall and spring semesters of the 1955-56 academic year.

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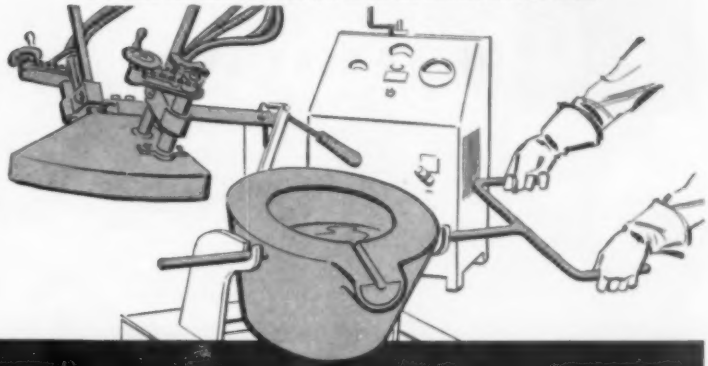

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INDEX OF ADVERTISERS

A

Abbott Ball Co. 64
Accurate Die Casting Co. 48
Acheson Colloids Co. 39
Ajax Engineering Co. 46
Alcaloy, Inc. 23
Allied Research Products, Inc. 63
Alloys & Chemicals Mfg. Co. 22
Almco Div., Queen Stove Works, Inc. 50
Aluminum Smelting & Refining Co. ..... Cover II
American Zinc Sales Co. 13
Apex Smelting Co. ..... Cover IV
Atlantic Chemicals & Metals Co. 79
Atols Tool & Mold Corp. 8
Auto-Diesel Piston Ring Co. 88

B

Badger Die Casting Corp. 40

C

Cannon-Muskegon Corp. 27
Cast-Master, Inc. 1
Celanese Corp. of America 15
Certified Alloys Co. ..... Cover II
Cleveland Automatic Machine Co., The 17
Cleveland Tool & Die Co. 77
Conforming Matrix Corp. 72

D

Detroit Electric Furnace Div., Kuhlman Electric Co. 89
Detroit Mold Engineering Co. 80
Dollin Corp. 5

E

Eastern Casting Corp., Div. Eastern Malleable Iron Co., The 77
Eclipse Fuel Engineering Co. 19
Engineered Precision Casting Co. 79

F

Federal Die Casting Co. 82
Federated Metals Div., American Smelting & Refining Co. 24
Fiske Bros. Refining Co. 89

G

Grav-I-Flo Corp. 56
Gries Reproducer Corp. 18
Groov-Pin Corp. 65
Samuel Greenfield, Inc. 20

H

Hammond Machinery Builders, Inc. 60
Haviland Products Co. 82
Henning Bros. & Smith, Inc. 75
Hoover Co., The ..... Cover III
Hydraulic Press Mfg. Co. 28

I

International Minerals & Metals Corp. 90
International Nickel Co., Inc., The 14
Investment Casting Co. 70

J

A. Johnson & Co. 89

K

Kuhlman Electric Co., Detroit Electric Furnace Div. 89

L

Lebanon Steel Foundry 74
Lindberg Engineering Co. 21
Litemetal Dicast, Inc. 68

M

Madison-Kipp Corp. 7
Midwest Machine Co., Inc. 42
Milwaukee Die Casting Co. 76
Mt. Vernon Die Casting Corp. 29

N

National Molded Products, Inc. 76
New England Die Casting Co. 30
Newark Die Hobbing & Casting Co. 10
Norton Co. 55

O

Oakite Products, Inc. 68
Ohio Precision Castings, Inc. 89

P

Pangborn Corp. 72
Parker-Kalon Corp. 66
Peerless Gear & Machinery Co. 87
Permanent Mold Die Co., Inc. 4
Plastics Engineering Co. 6
Precision Castings Co. 11
Pressure Castings, Inc. 78
Procunier Safety Chuck Co. 69

R

Reed-Prentice Corp. 9
Rossborough Supply Co. 84
Roto-Finish Co. 73
Rutley Industries, Inc. 61

S

G. W. Smith & Sons, Inc. 25
Sonken-Galamba Corp. 87
Frederic B. Stevens, Inc. 54
Strah Die Moulded Castings Co. 87
Stroman Furnace & Engineering Co. 12

T

Tamms Industries, Inc. 72
Thompson Products, Inc., Light Metals Div. 2
Tri-State Die Casting Corp. 88

U

United Chromium Div., Metal & Thermit Corp. 57

V

Vanadium-Alloys Steel Co. 71
Van Dorn Iron Works Co. 69

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One Fine Zinc For Die Casting

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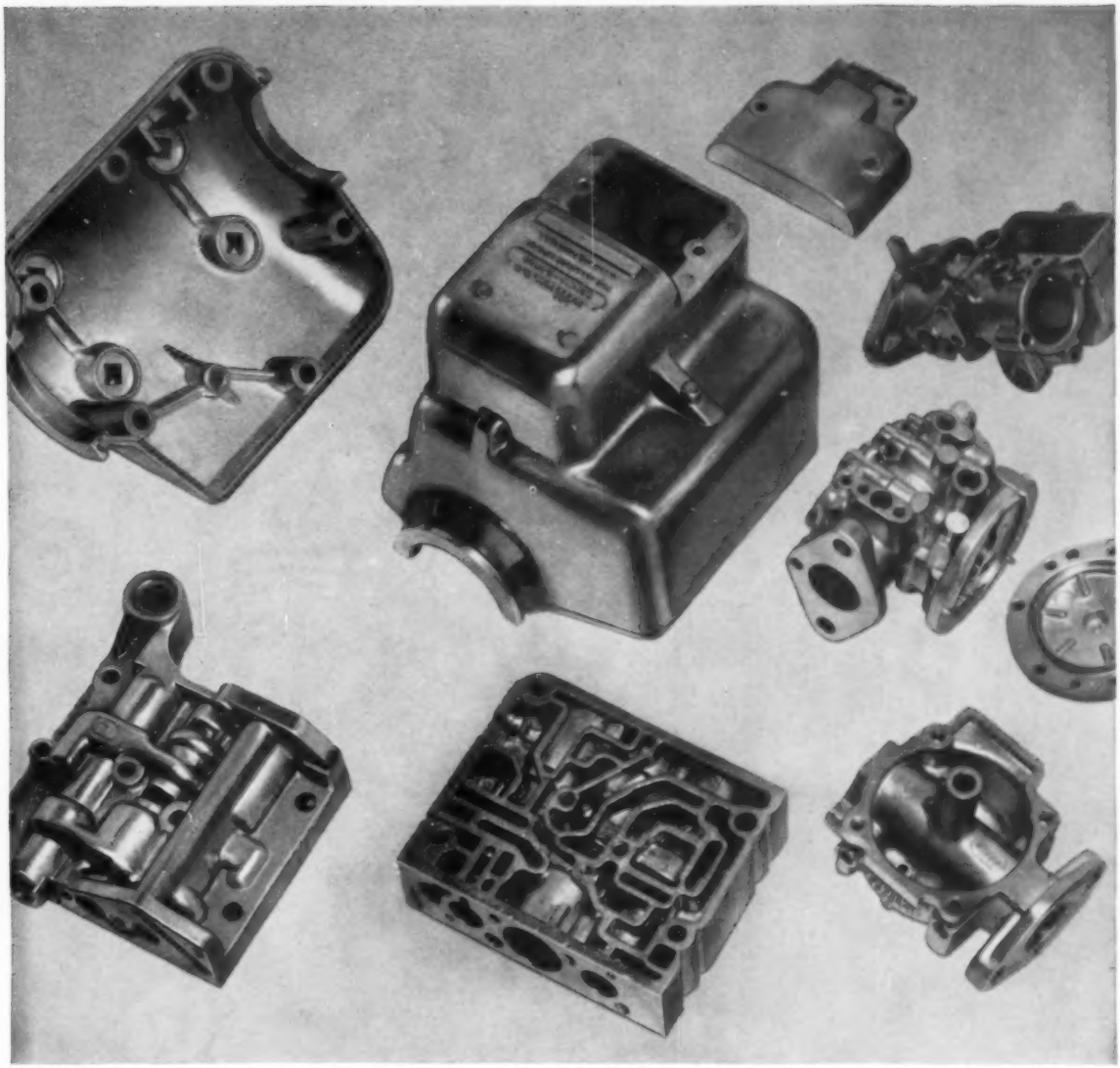

Can Die Castings Like These Cut Costs For You?

Every die casting you see here is cutting somebody's costs. And every casting you see here is *better* because of Hoover's years of die-casting experience.

Since 1922, veteran Hoover design engineers, X-ray and metallurgical technicians have been constantly developing better zinc and aluminum alloys, improved die designs, and more efficient production methods. The experience and techniques developed through these years produces superior castings—at greater savings.

Hoover is now producing strong, well-designed castings, like those shown here, for Tillotson Carburetors, Alliance Tenna Rotors, Detroit Transmission Division of General Motors, Ford Motor Company, Remington Rand, West Bend Aluminum, and many other manufacturers who demand precision while they watch costs.

Why not write and ask to have a Hoover Sales Engineer pay you a call? Write, too, for your copy of "Hoover Die Castings," an informative booklet of THE HOOVER COMPANY, Die Castings Division, North Canton, Ohio.

HOOVER

Specialists in the field of quality die casting for over 30 years

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Portrait of hundreds of different die casting problems

solved with APEX die casting ALLOYS

aluminum and zinc

Apex quality ingot is making the die caster's job easier and his production more economical in hundreds upon hundreds of applications that have varying alloy requirements. Apex produces to specification—controlling quality with rigid electronic quantometer analysis throughout the melting and refining processes. Apex uses microscopic, macroscopic, radiographic and x-ray diffraction equipment to insure clean, gas free ingot of the proper grain size, fluidity and castability.

You can *depend* on the products and service of Apex, one of America's largest smelters and suppliers of aluminum and zinc alloys to the foundry industry. Specify Apex and know you're *right!*

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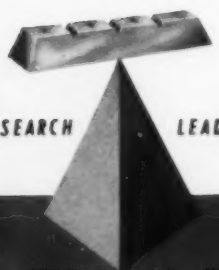

RESEARCH LEADERSHIP BACK OF EVERY INGOT

Send for our helpful booklet, "Die Casting Alloys." Shows composition, properties, other data on Apex products. No obligation.

APEX SMELTING COMPANY

CHICAGO CLEVELAND LOS ANGELES